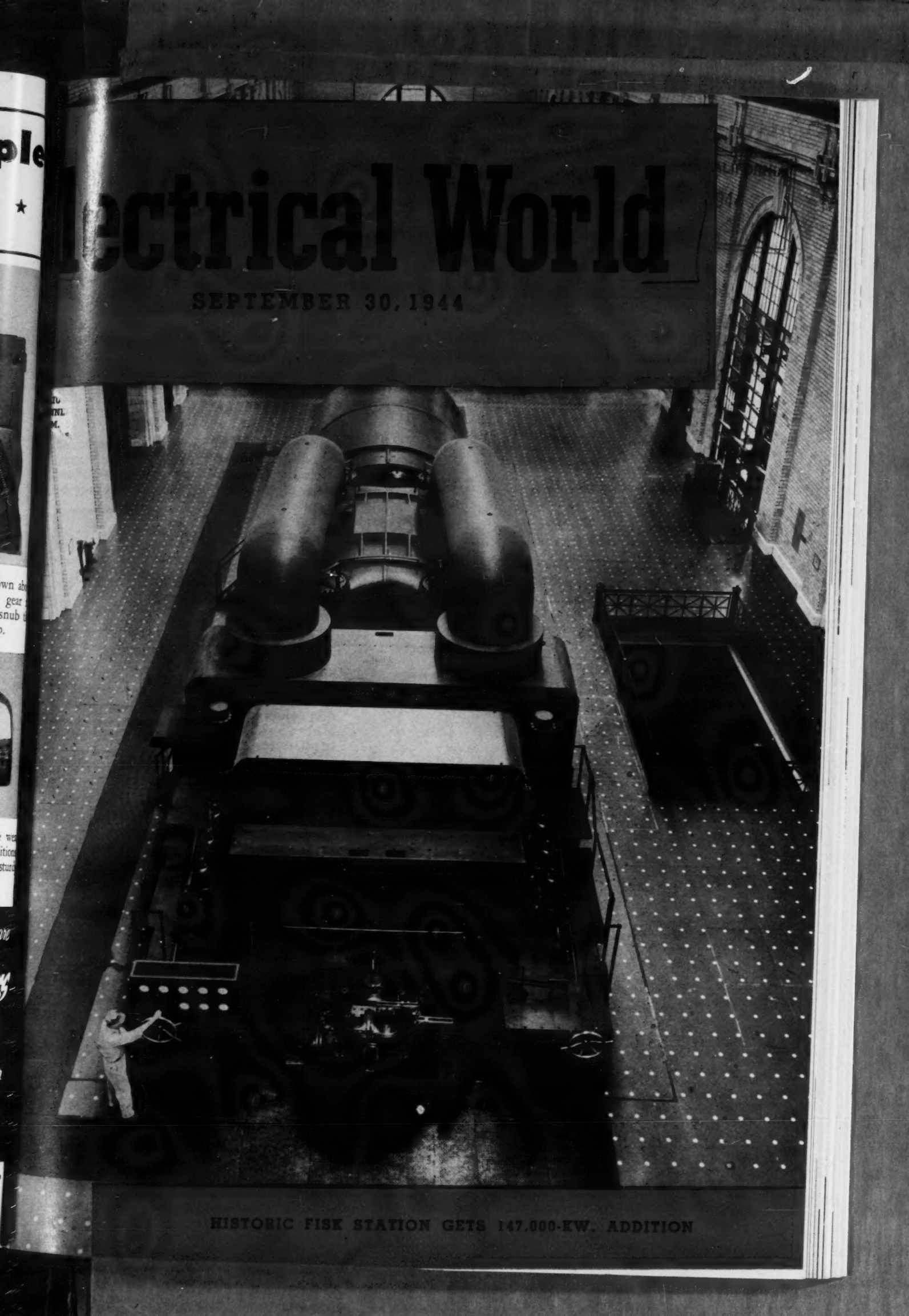
lectrical World
SEPTEMBER 30, 1944
HISTORIC FISK STATION GETS 147,000-KW. ADDITION

HOW *crows'nest* REPLACES MILES OF MAKESHIFTS!

Dancing days are over for Ruth Johnson, 24, former showgirl, now learning to be aviation mechanic at LaGuardia Field. Here she is seen at work on fin of one of huge multimotored transports. —Story on Page 14
SUNDAY NEWS
NEW YORK'S PICTURE NEWSPAPER

UP-IN-THE-AIR-JOBS DONE *SPEEDILY* AND SAFELY FROM THE PLATFORM OF THIS AERIAL LADDER

Up-in-the-air-work in industries of every sort has found new safety, new speed, new flexibility due to the Murray Crows'nest aerial ladder. It has long been the standard maintenance ladder of the electrical industry. It may be mounted on a variety of bases, from motor trucks to caster trailers, live skids, wagon trailers, etc. — whichever best suits individual plant conditions. It is particularly efficient for servicing — without interrupting production — fluorescents and other luminaires, as well as unit heaters, sprinkler heads, painting. Many are being used for servicing and inspecting planes at air fields and modification centers. Metropolitan Device Corporation, Brooklyn 16, N. Y.

Metropolitan Device Corp.
Brooklyn 16, N. Y

Send data (without obligation) on Murray Crows'nest suitable for our requirements. Ladder must reach _____ feet high, and extend _____ feet side-ways. Aisle width is _____ feet.

Name and Title _____

Company _____

Address _____

Murray

DEMOUNTABLE *crows'nest*

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 70 YEARS

September 30, 1944 — Vol. 122, No. 14

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CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY,
330 West 42nd Street, New York 18, N. Y.
Director of Circulation:

Please change my address on Electrical World

From .....

.....

To .....

.....

Signed .....

don't straitjacket a Good Genie

Don't straitjacket the genie of Electricity by poor planning of the electrical wiring in your post-war buildings. Anemic circuits, wiring that is insufficient and too small in capacity, lose wattage that is paid for but never gets to the machine or appliance.

Not only must yesterday's wiring requirements be discarded as the criterion, but proper note must be taken of wiring needs far into the future. To do any less is to condemn a building to early electrical obsolescence, for the greater use of electrical equipment that is promised us will be seriously hampered in buildings that are inadequately wired.

Adequate, proper wiring is a *must*, if tomorrow's buildings are to make full use of cheap, plentiful, labor saving electricity. The Okonite Company, Passaic, New Jersey.

SAME SIZE CONDUIT

#14 #12

Wire *size* is as important as having sufficient wiring. For instance, No. 14 wire has been a standard in building for generations yet No. 12 wire will carry one-third more current, reduce voltage drop by more than a third, deliver more power for your money and yet requires no larger conduit or fittings.

ADEQUATE WIRING THE KEY TO INCREASED PRODUCTION

OKONITE and HAZARD

INSULATED WIRES AND CABLES

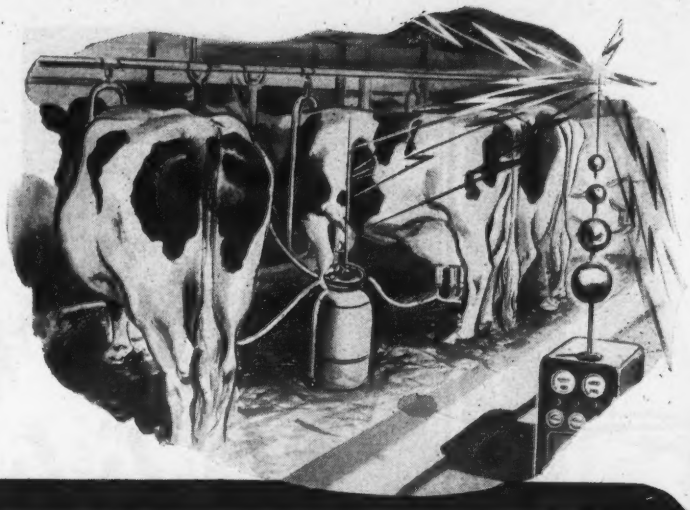
3608

GOOD ADVICE FOR Utility Power Salesmen to give their local ARCHITECTS CONTRACTORS INDUSTRIAL and COMMERCIAL CUSTOMERS a MUST

Post-war pipe dreams you better not count on

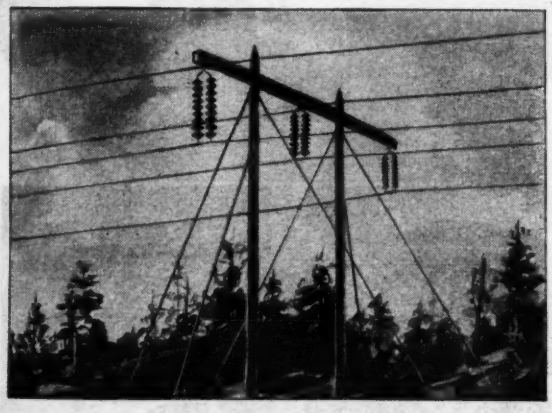
RURAL POWER BY RADIO WAVES

Perhaps someday every farm, or every barn, will receive its electric power over a radio carrier wave. Churns and pumps will whistle while they work on wireless power your company supplies. However, your customers will have a mighty long wait before it happens.



BUT RIGHT NOW YOU CAN PLAN—

SUPPORT FOR YOUR LINE STRUCTURES WITH GALVANIZED STEEL STRAND



Guy, span and ground wires need the tensile strength, ruggedness and endurance which steel alone can give them. All three, plus economy, are combined in Crapo galvanized steel strand. Long life and low maintenance of this superior steel strand is a matter of record with America's leading utilities.

Rigid manufacturing controls make certain that all Crapo galvanized steel strand meets every requirement for tensile strength, elongation, gauge, galvanizing and ductility. Seven wire strand is available in 9 sizes from 5/8 to 5/32 inch diameter; three strand from 1/4 to 3/8 inch.

FOR RURAL LINES — Crapo HTC 130 low-resistance, low-reactance steel conductors effect important economies in construction and maintenance, and reduce transmission losses.

GRAYBAR'S NATIONWIDE NETWORK

of more than 80 warehouses assures you a convenient local source of supply for more than 60,000 electrical items — backed by experienced power transmission and distribution application aid, plus assistance on problems of lighting, wiring and communication. A Graybar Man near you is ready to make your electrical supply problems his personal responsibility. Why not take advantage of his time-saving assistance?

5516

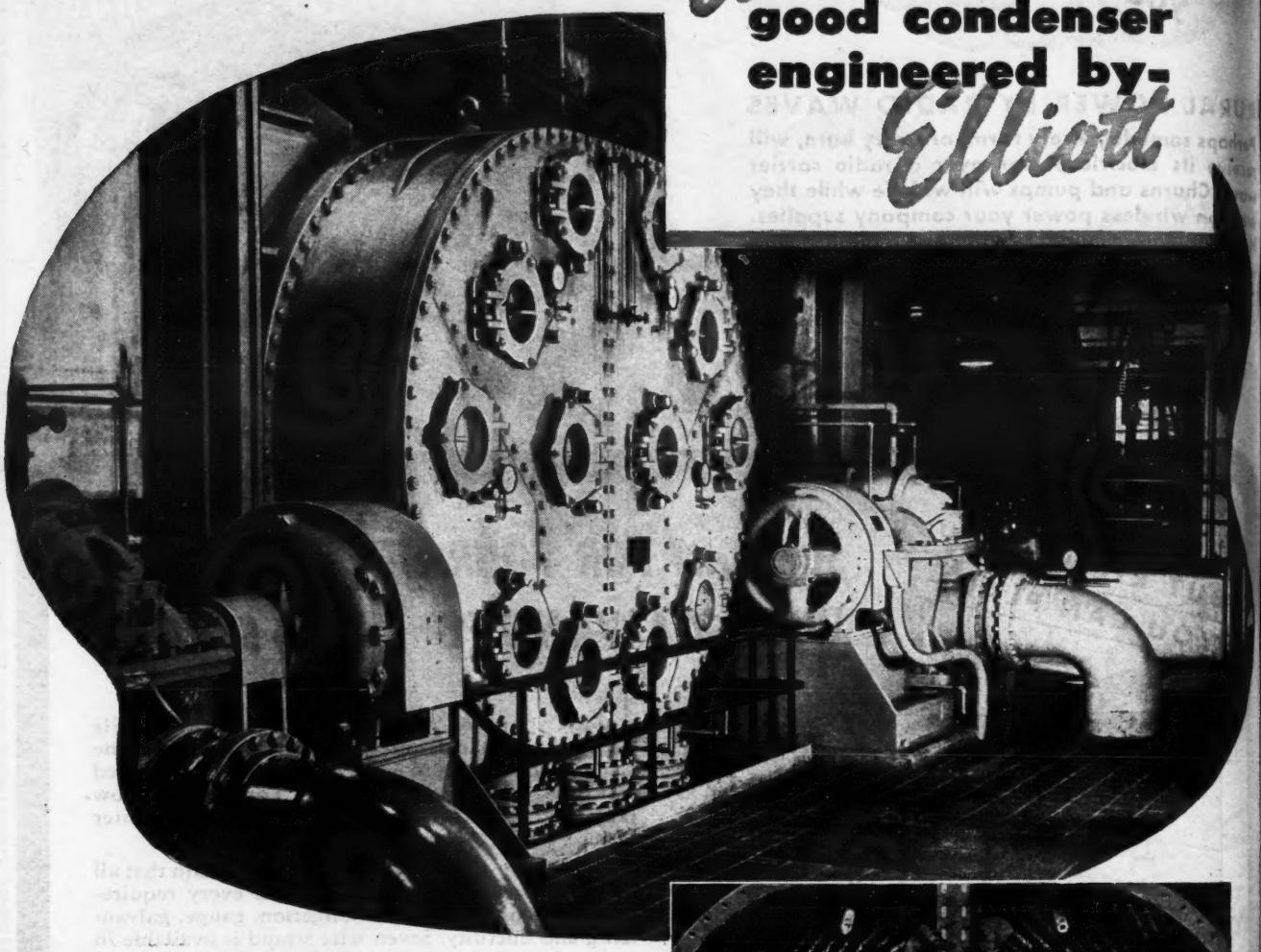
via GraybaR

RURAL ELECTRIFICATION MATERIALS AND EQUIPMENT — Graybar's new 88-page time-saving buying guide is now available from your local Graybar representative (or write direct if you prefer.) Contains valuable new installation data.

GRAYBAR ELECTRIC COMPANY

IN OVER 80 PRINCIPAL CITIES

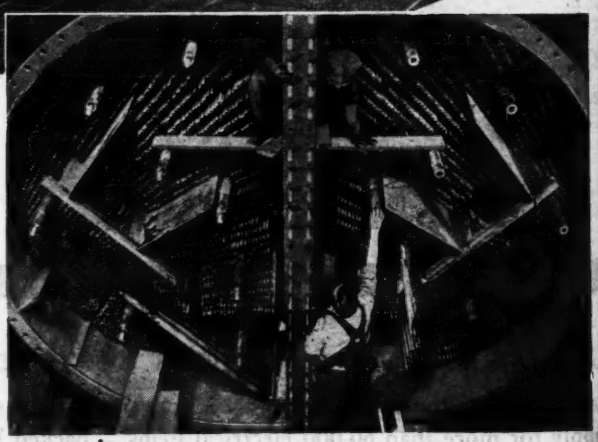
Another good condenser engineered by- Elliott



IN THE WESTOVER STATION of New York State Electric and Gas Corporation, this recently installed Elliott condenser serves a 35,000-kw turbine. The condenser contains 27,000 sq. ft. of surface, is arranged two-pass, with divided water-boxes, and is equipped with backflush water valves which enable the operator to change the direction of flow through tubes and water-boxes to remove trash. Beyond this, it is of typical Elliott design, featuring large areas, fan type tube arrangement, and no baffles to cause pressure drop by directional changes in steam flow.

This condenser is making a very good record, fully in line with the performance Elliott users expect and Elliott engineers demand, of Elliott condensers.

ELLIOTT COMPANY
Heat Transfer Dept., JEANNETTE, PA.
DISTRICT OFFICES IN PRINCIPAL CITIES



Tube arrangement tells the story of condenser performance. Elliott engineers have developed a system of tube spacing which insures the maximum number of tubes in direct contact with the incoming steam, regulation of steam velocity because tubes are arranged in converging straight lines, and maximum steam penetration. Partial tube supports, cut out in the steam lane section, result in complete longitudinal steam distribution with minimum pressure drop. Water collecting plates are provided to prevent blanketing of tubes in the lower half of the condenser.

C-382

ELLIOTT Company

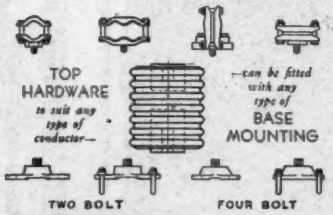
STEAM TURBINES • GENERATORS • MOTORS • CONDENSERS • FEEDWATER HEATERS AND DEAERATORS
STEAM JET EJECTORS • CENTRIFUGAL BLOWERS
TURBOCHARGERS FOR DIESEL ENGINES • TUBE CLEANERS • STRAINERS • DESUPERHEATERS • FILTERS

CHECK the FACTS

UNITS STACKED FOR INSPECTION AND EXPORT SHIPMENTS

1. Maximum strength to withstand mechanical stress and electrical shock.
2. Hardware attached with resilient alloy in place of cement, eliminates spot loading.
3. Clamp surfaces designed to maintain constant clamping pressure.
4. Uniformity in strength, dimension and appearance provided by jig assembly.

Made to all NEMA specifications-
7500 to 34,500 Volts



The Check List

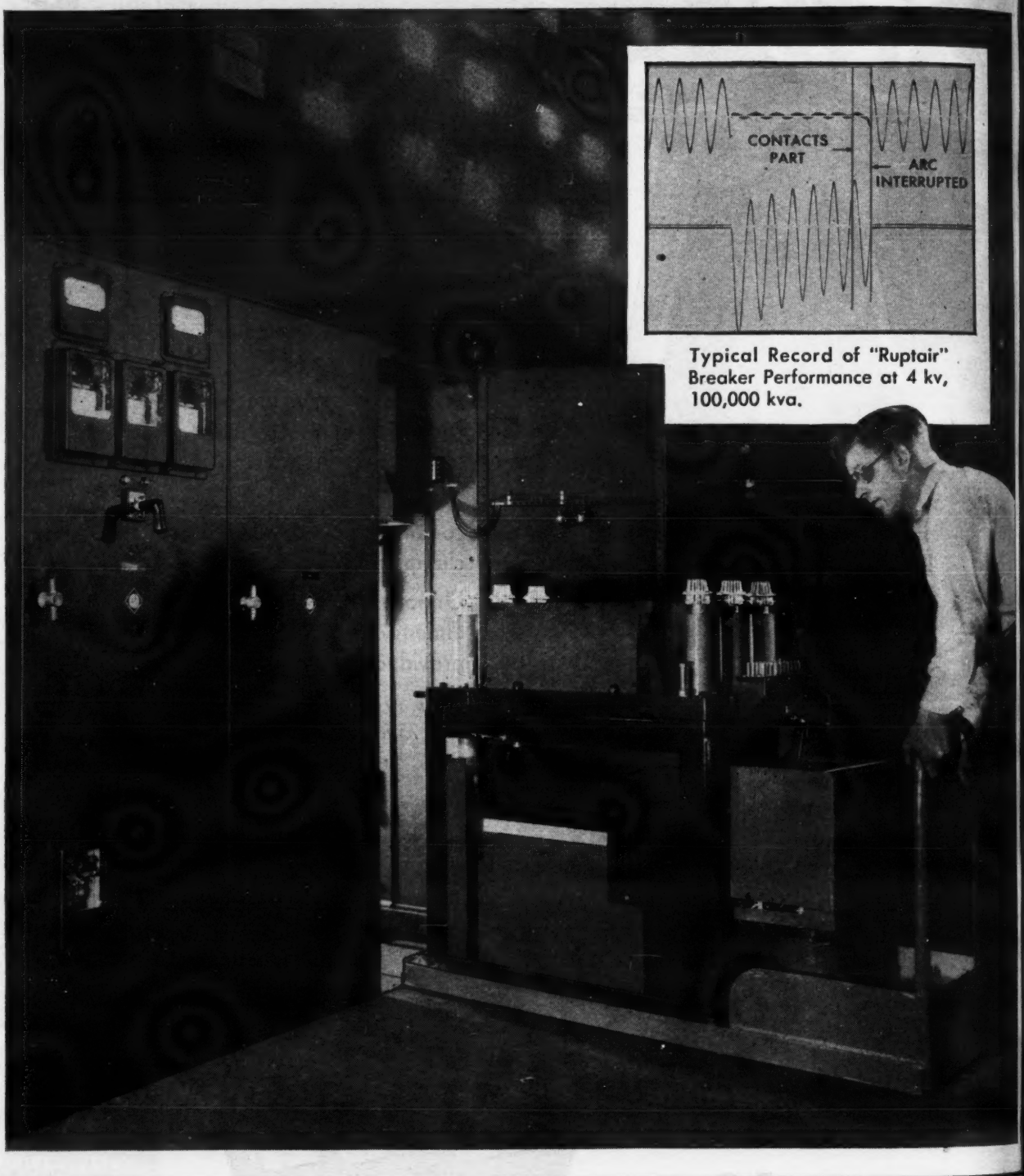
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- AIR BREAK SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

R&IE

Type A2 INDOOR BUS SUPPORTS

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.
IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

PRODUCT OF THE MONTH



Typical Record of "Ruptair" Breaker Performance at 4 kv, 100,000 kva.

ALLIS CHALMERS

"RUPTAIR" BREAKER

MILWAUKEE, WIS.—The Allis-Chalmers "Ruptair" magnetic air circuit breaker is available in oilless, high voltage switchgear rated 5,000 volts and below, 150,000 kva interrupting capacity and below.

In both overall and the critical front-to-back dimensions, the "Ruptair" breaker provides the most compact oilless unit available today, when installed in metal-clad switchgear. This space advantage results from a design incorporating vertical lift of the circuit breaker element, plus a novel arrangement of the arc chute with respect to the main contacts.

Because contacts in the "Ruptair" breaker separate in a horizontal direction, thermal effect motivates the arc directly up into the arc chute. The rush of the arc into the chute is greatly accelerated by the magnetic field of a powerful blowout coil in the circuit. This magnetic effect forces the arc into inverted V-shaped slots in the arc chute baffle plates, causing rapid cooling and breaking up of the gases in the arc stream.

Complete inspection of the "Ruptair" self-contained assembly can be accomplished without disturbing the arc chute or magnetic circuit. Removing interphase barriers uncovers the contact structure of the breaker to full accessibility. Write today for Bulletin B6346.

A 1784

MILWAUKEE, WIS.

So Simple, So Fa

YOU SAY GOODBY to by-guess and by-memory methods when you plan substations *visually* — with the help of Allis-Chalmers' new "Unit Sub Builder" Set!

At a glance you see what's available — the various ways it can go together — and build up the solution to your power distribution problem *right on the top of your desk.*

The new "Unit Sub Builder" will be shown by a field engineer from your nearby A-C district office on your request. A new Slide Rule and Check List save your time, contribute to better planning. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

• • •

♪ *Tune in the Boston Symphony, Blue Network, every Sat. Eve.*

A 1745

ALLIA

ractical, So Fast-

Visual Planning for Unit Subs!

Here's the new way to buy Unit Sub-tations—with your eyes wide open —aided by accurate scale models of Allis-Chalmers electrical apparatus.

YOUR UNIT SUB IDEAS WORKED OUT WITH
HALMERS *"Unit Sub Builder" Set*

Geon outlasts ordinary insulation 168 to 1!

A new type of electrical assault wire insulation was tested comparatively against ordinary insulation in Army maneuvers not along ago. Stretched across a highway—run over by tanks, trucks, jeeps, men—the old kind lasted 2 hours. *Under the same conditions GEON 6461 lasted 2 weeks.*

That's one reason why GEON insulated assault wire by the thousands of miles is being used for communications in combat service everywhere.

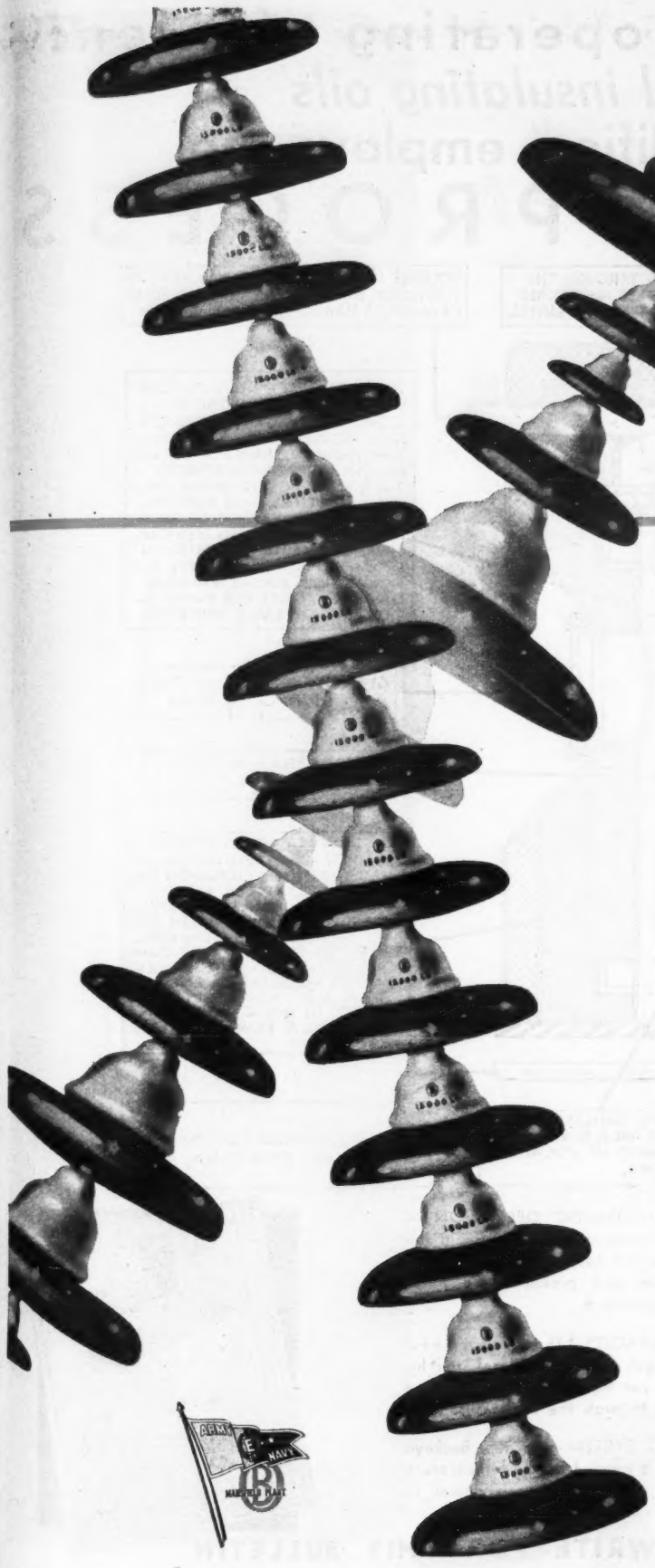
Here are some other reasons. No braid is needed, the smooth GEON coating makes the wire easy to handle, prevents catching on rocks, bushes, other obstructions. Its resistance to weather, aging, and abrasion means communications are surer, that messages will get through.

Right now GEON is available to industrial users subject to allocation under General Preference Order M-10. However, limited quantities can be had for experiment. And in days to come, GEON's outstanding characteristics will mean better, cheaper, safer industrial and domestic wiring.

For more complete information, or for help on specific problems, write, Department C-4, Chemical Division, The B. F. Goodrich Company, Rose Building, E. Ninth and Prospect, Cleveland 15, Ohio.

Geon
Vinyl Resins & Plastics

CHEMICAL DIVISION
THE B. F. GOODRICH COMPANY
ROSE BUILDING, E. NINTH & PROSPECT, CLEVELAND 15, OHIO



WHICH

string of insulators is the STRONGER?

For years, considerable strength variation in suspension insulators was accepted as inevitable. To be on the safe side, engineers would specify high average strengths beyond all reasonable requirements, just to be a little more sure of adequate strength; and pay a premium for it...This is no longer the case. Every O-B suspension unit is permanently branded with a strength rating--***minimum strength.*** O-B suspension units may be combined and the strength of that string will have a known value... It took years of development in manufacturing, testing, and inspection to arrive at the point where specific minimum strength could be established. But, today, there is no longer any guess-work required in specifying insulators. You don't have to pay extra for more strength than you ever need, just to come a little closer to getting what you want. Buy O-B suspension insulators with complete assurance. They have the kind of strength that *counts* because you can *count* on it!

2489-H

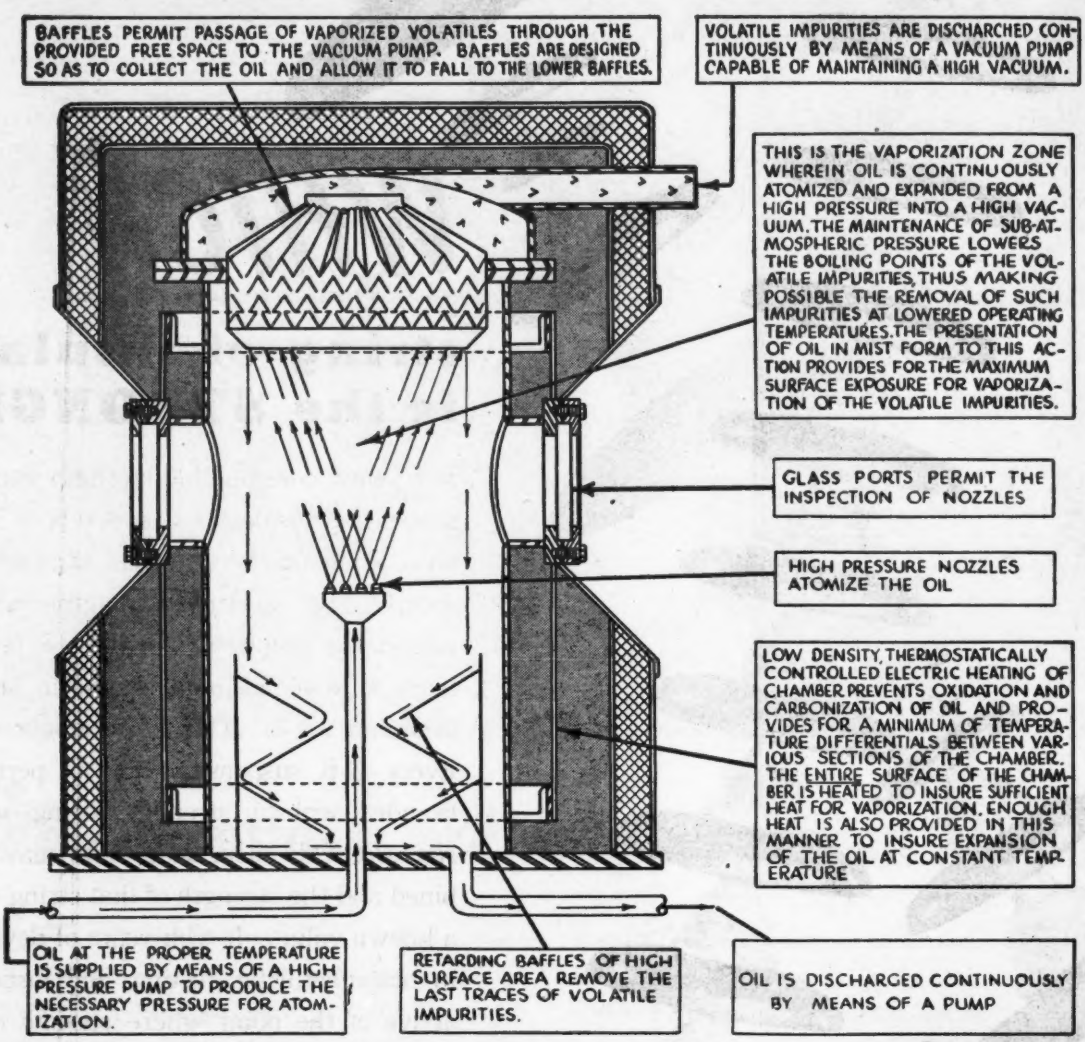
Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS COMPANY, LIMITED
NIAGARA FALLS, ONTARIO

BACK THE INVASION
WITH WAR BONDS

To maintain high operating efficiency *of electrical insulating oils* The "Hydrovolifier" employs the BUCKEYE PROCESS


BAFFLES PERMIT PASSAGE OF VAPORIZED VOLATILES THROUGH THE PROVIDED FREE SPACE TO THE VACUUM PUMP. BAFFLES ARE DESIGNED SO AS TO COLLECT THE OIL AND ALLOW IT TO FALL TO THE LOWER BAFFLES.
VOLATILE IMPURITIES ARE DISCHARCHED CONTINUOUSLY BY MEANS OF A VACUUM PUMP CAPABLE OF MAINTAINING A HIGH VACUUM.
THIS IS THE VAPORIZATION ZONE WHEREIN OIL IS CONTINUOUSLY ATOMIZED AND EXPANDED FROM A HIGH PRESSURE INTO A HIGH VACUUM. THE MAINTENANCE OF SUB-ATMOSPHERIC PRESSURE LOWERS THE BOILING POINTS OF THE VOLATILE IMPURITIES, THUS MAKING POSSIBLE THE REMOVAL OF SUCH IMPURITIES AT LOWERED OPERATING TEMPERATURES. THE PRESENTATION OF OIL IN MIST FORM TO THIS ACTION PROVIDES FOR THE MAXIMUM SURFACE EXPOSURE FOR VAPORIZATION OF THE VOLATILE IMPURITIES.
GLASS PORTS PERMIT THE INSPECTION OF NOZZLES
HIGH PRESSURE NOZZLES ATOMIZE THE OIL
LOW DENSITY, THERMOSTATICALLY CONTROLLED ELECTRIC HEATING OF CHAMBER PREVENTS OXIDATION AND CARBONIZATION OF OIL AND PROVIDES FOR A MINIMUM OF TEMPERATURE DIFFERENTIALS BETWEEN VARIOUS SECTIONS OF THE CHAMBER. THE ENTIRE SURFACE OF THE CHAMBER IS HEATED TO INSURE SUFFICIENT HEAT FOR VAPORIZATION. ENOUGH HEAT IS ALSO PROVIDED IN THIS MANNER TO INSURE EXPANSION OF THE OIL AT CONSTANT TEMPERATURE
OIL AT THE PROPER TEMPERATURE IS SUPPLIED BY MEANS OF A HIGH PRESSURE PUMP TO PRODUCE THE NECESSARY PRESSURE FOR ATOMIZATION.
RETARDING BAFFLES OF HIGH SURFACE AREA REMOVE THE LAST TRACES OF VOLATILE IMPURITIES.
OIL IS DISCHARGED CONTINUOUSLY BY MEANS OF A PUMP

1 THE "HYDROVOLIFIER" — Employing the Buckeye Process—cleans—dehydrates—degasifies—stabilizes electrical insulating oils.

2 A PORTABLE, COMPACT MACHINE—Permits servicing of transformers in place without service interruptions.

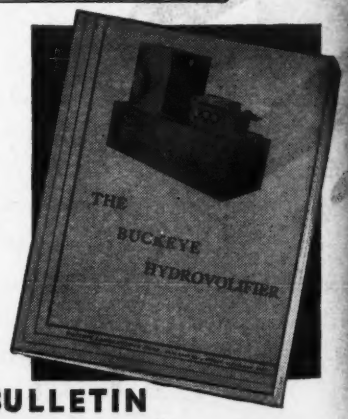
3 LOW OPERATING COSTS—On larger models less than one cent per gallon.

4 A CONTINUOUS PROCESS—Oil from transformer flows through Hydrovolifier is returned to transformer in a continuous circuit.

5 SIMPLE, AUTOMATIC OPERATION — Only three connections are made in the inlet and outlet lines and power circuit. Temperatures and pressures are automatically controlled.

6 LARGE CAPACITY—Three standard sizes—100 gal. per hr.—300 gal. per hr.—500 gal. per hour. Oil serviced in a single pass through the apparatus.

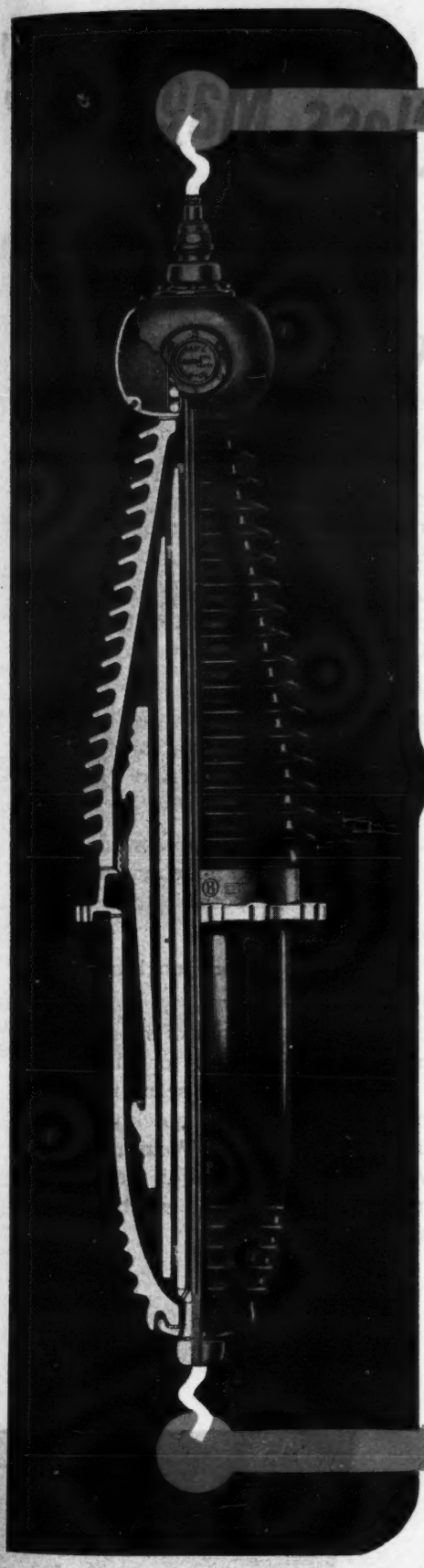
7 A CLOSED SYSTEM — In the Buckeye Process oil is treated at low temperature under high vacuum. No air comes in contact with oil during processing.



FOR COMPLETE INFORMATION—WRITE FOR THIS BULLETIN

BUCKEYE LABORATORIES CORP.

1965 EAST 66TH STREET . . . CLEVELAND 3, OHIO



A SOUND INSULATION
That Stays That Way
Makes O-B Bushings Perform

Wherever insulation is called upon to stand up indefinitely in the face of hard service, porcelain is selected... Nowhere are insulation demands any more severe than inside an apparatus bushing, and here O-B employs concentric porcelain tubes surrounded by oil...Porcelain has been proved countless times to be an excellent insulation and, more important, *it stays that way!* This is a very desirable quality in a bushing--a quality that is yours when you specify O-B.

Ohio Brass
MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

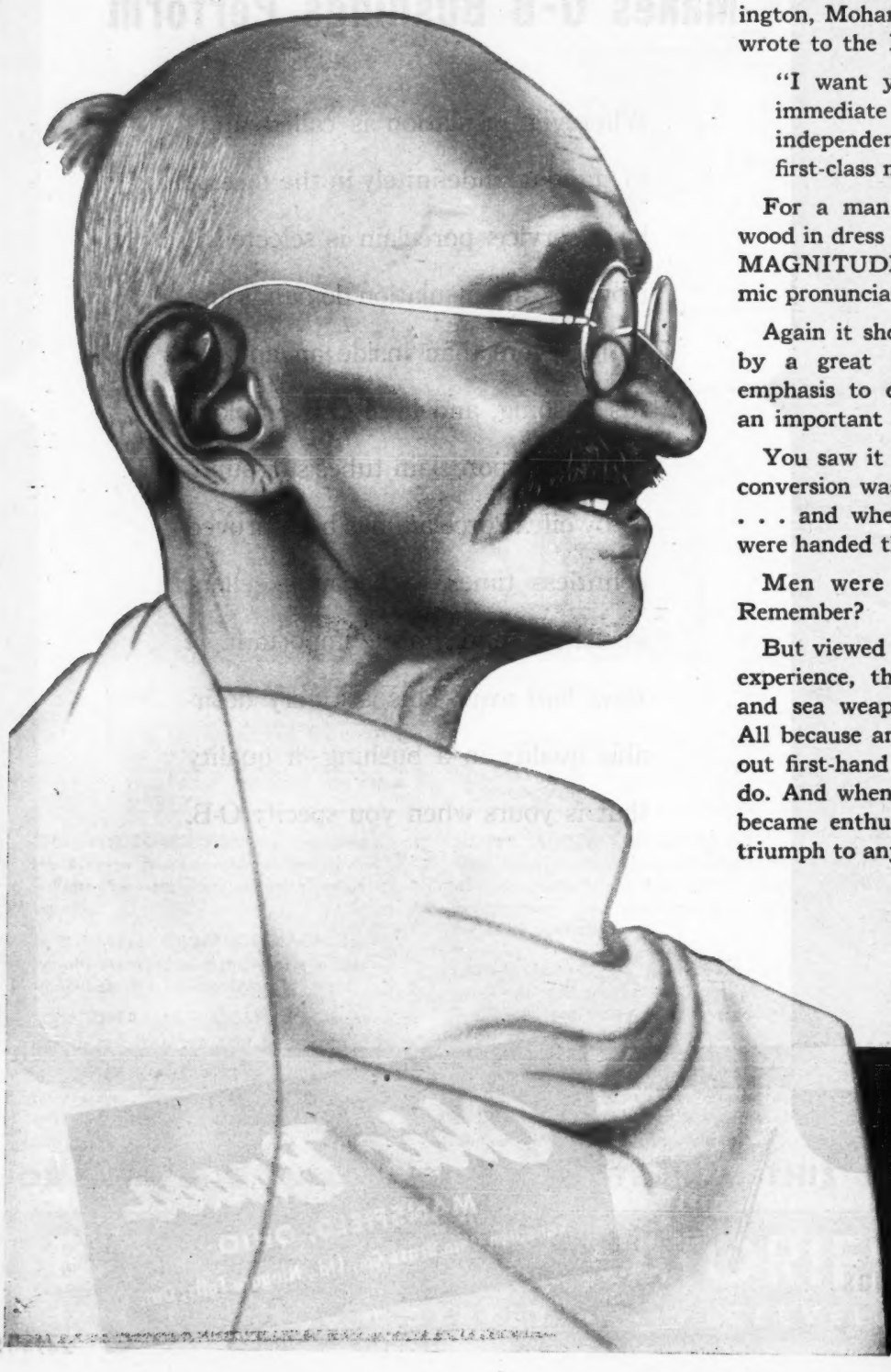
KEEP BUYING WAR BONDS

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

2494-H

Then he said to himself

"A War Measure of First-Class Magnitude"



WHEN the standing of India was occupying the attention of Washington, Mohandas Karamchand Gandhi wrote to the India League of America:

> "I want you to look upon the immediate recognition of India's independence as a war measure of first-class magnitude."

For a man so definitely non-Hollywood in dress or words "FIRST-CLASS MAGNITUDE" amounts to a cataclysmic pronunciamento.

Again it shows that one who is fired by a great idea automatically adds emphasis to enthusiasm! And *that* is an important business measure.

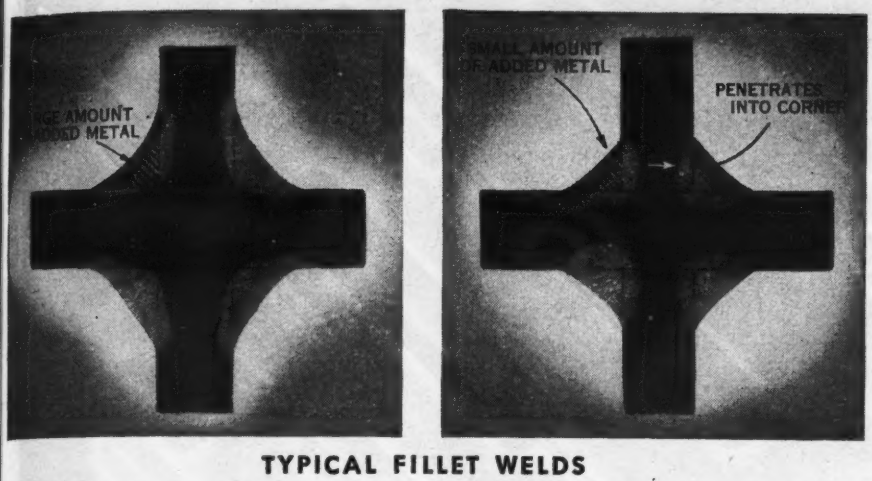
You saw it well illustrated when war conversion was hurled at manufacturers . . . and when "impossible" schedules were handed them.

Men were far from enthusiastic. Remember?

But viewed in the light of subsequent experience, those quotas for air, land and sea weapons today seem modest. All because aroused men quickly found out first-hand what Arc Welding could do. And when it did the job well, they became enthusiastic . . . which brings triumph to any front.

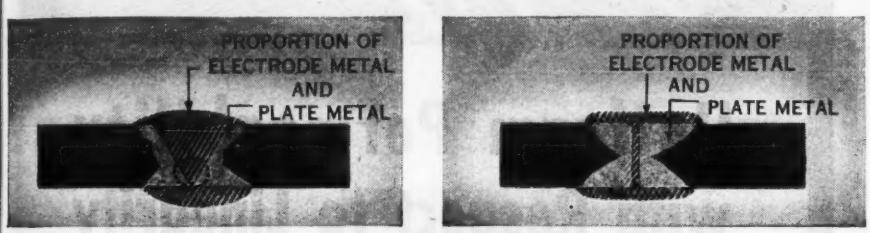
"A War Measure of First-Class Magnitude"...he says

CONVENTIONAL WELDING | **"FLEET-WELDING"**



TYPICAL FILLET WELDS

STRENGTH:	Stronger than plate	STRENGTH:	Stronger than plate
SPEED:	5" per min.	SPEED:	12" per min.
COST:	100%	COST:	42%



TYPICAL BUTT WELDS

STRENGTH:	Stronger than plate	STRENGTH:	Stronger than plate
SPEED:	2" per min.	SPEED:	9" per min.
COST:	100%	COST:	25%

LOOK, MAHATMA: While you pondered on the magnitude of political measures for winning, Lincoln Engineers were enthusiastically working out a very practical measure that is away out in front in magnitude:

"FLEET-WELDING"

A First-Class Production Measure ... of First-Class Magnitude

This new, revolutionary technique using "ARC-FORCE" to speed the welding of all types of joints in plate, shapes and sheet is bringing back reports of 25% to 75% faster welding . . . also savings in electrode material and power. Cases also are reported where back-chipping and plate beveling are eliminated.

The savings shown at left are typical of this new technique developed by Lincoln engineers.

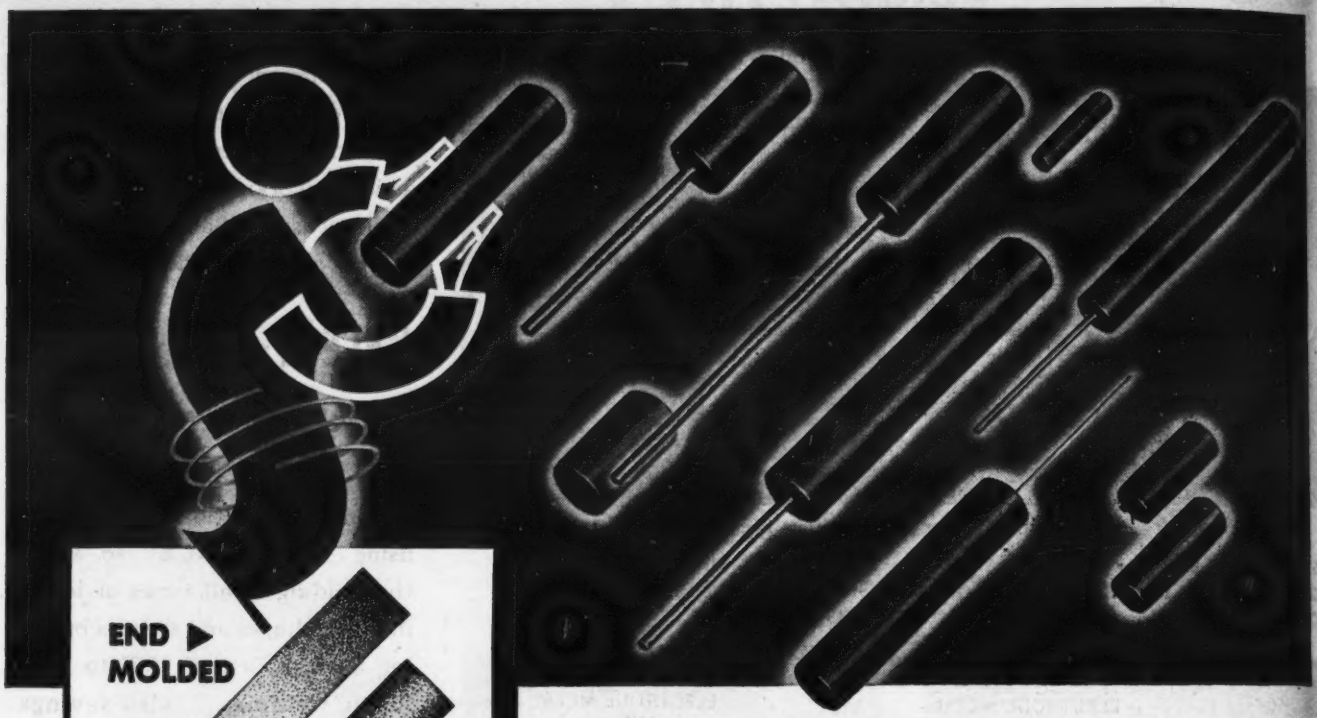
A Lincoln engineer is available nearby to help you apply "Fleet-Welding" Technique. Write for Bulletin No. 440 which gives complete explanation of the simple technique and the welding procedures.

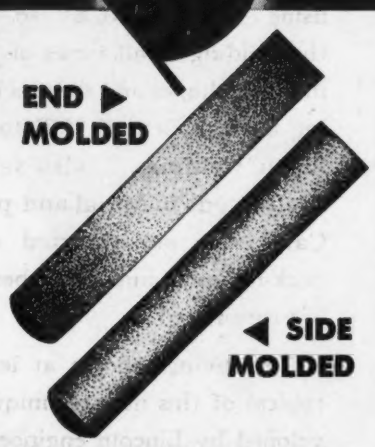
THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

America's greatest natural **recourse**

ARC WELDING

SIDE-MOLDED IRON CORES





This diagrammatic illustration shows how conventional cores, molded by applying pressure to the ends, results in a dense grouping of iron particles at these points. In side-molded cores, however, any density resulting from molding pressure extends evenly along the entire length of the core, assuring uniform permeability with respect to length.

Uniform Permeability with Respect to Linearity

Use in many applications has shown Stackpole side-molded iron cores outstandingly superior to conventional end-molded cores for permeability tuning in the broadcast bands. Similar side-molded units are now available for short wave frequencies including television and frequency modulation.

As the name implies, cores of this type are molded by applying pressure from the sides rather than from the ends. The resulting units show very little variation in density or permeability with respect to length, thus assuring a high degree of uniformity.

WRITE FOR CATALOG! *Other Stackpole Iron Core types include both standard and high-frequency types; insulated types; iron cores for choke coils, etc. Our new Catalog RC6 describes these as well as fixed and variable resistors, and our complete line of inexpensive line, slide, and rotary-action switches.*

STACKPOLE CARBON COMPANY, ST. MARYS, PA.

STACKPOLE

IRON CORE HEADQUARTERS

another Westinghouse **"FIRST"** in capacitor protection

BETTER WEATHER RESISTANCE with Zinc-Spray FINISH

Now, in addition to the exclusive Solder-Seal which protects operating elements, Westinghouse Capacitors offer new and greater protection against weather. Outdoor hanger-type capacitors are now *Zinc-Spray finished.*

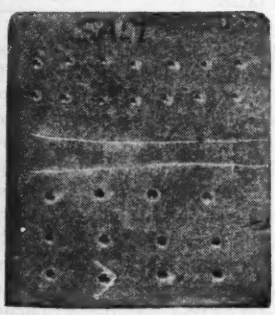
A zinc coating, five to six times the thickness of hot-dip galvanizing, provides a strong, durable finish that gives effective protection against rust and atmospheric corrosion. This new finish also has greater resistance to any abrasion encountered while units are being installed on poles. Even if scratches penetrate through the zinc coating, the zinc provides cathodic action to protect the steel.

Zinc-Spray means far greater life for outdoor capacitors and reduced replacement costs resulting from corrosion.

This new finish is now provided on all Westinghouse outdoor hanger-type capacitors . . . another advantage in the long list of outstanding Westinghouse capacitor developments. For more information about this new capacitor protection, ask your nearest Westinghouse office for R-1102, or write Westinghouse Electric & Manufacturing Company, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-90535

ZINC-SPRAY FINISH...

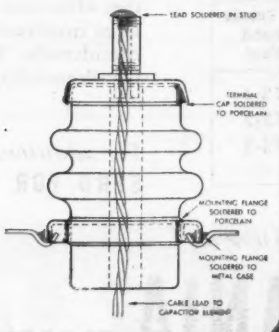
Photomicrograph of Westinghouse Zinc-Spray finish, magnified 100 diameters. Note firm bond between zinc and steel and the extra-thick protection of the .005 to .006-inch coating.



Steel sample, coated with Westinghouse Zinc-Spray, was tested by scratching and drilling through the finish into the steel base. After immersion in salt water and exposure through two months of wet weather in a corrosive industrial atmosphere, neither holes nor scratches show any sign of rust or corrosion.

. . . plus Westinghouse Solder-Seal

The solder-sealed bushing makes the capacitor completely hermetically-sealed. Metal-to-metal porcelain soldering by the exclusive Westinghouse process eliminates all gaskets, protects the working elements from moisture


LEAD SOLDERED IN STUD
TERMINAL CAP SOLDERED TO PORCELAIN
MOUNTING FLANGE SOLDERED TO PORCELAIN
MOUNTING FLANGE SOLDERED TO METAL CASE
CABLE LEAD TO CAPACITOR ELEMENT

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

CAPACITORS

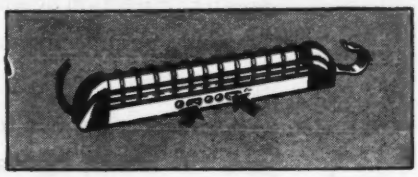
Fluorescent operating hints

No. 6 of a series by SYLVANIA for all users of fluorescent lighting

WHICH STARTER TO USE

To light a fluorescent lamp, the two cathodes should be preheated for a short interval. The circuit must then be broken to establish the lighting arc. The fluorescent starter performs this function, acting as a time-delay switch. One starter is required for each lamp in a fixture. (Research has eliminated the starter from the fluorescent circuit in the laboratory, but starterless fluorescent equipment is not yet commercially available in quantities.) Following are the types of starters in most common use today:

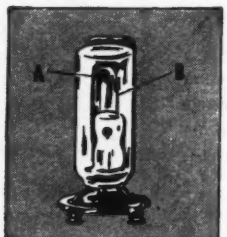
MANUAL STARTER



Manual starters are the simplest type and are used principally on desk lamps or other portable fixtures. For example, in the Sylvania P-7 Fluorescent Extension Cord Lamp shown above, one switch turns on the current, and a second is pressed until the ends of the lamp glow to indicate adequate preheating. Then, the second switch is opened so that the lamp can strike its lighting arc. Manual starting is impractical for large installations or inaccessible fixtures, for which the following types of automatic starters have been developed.

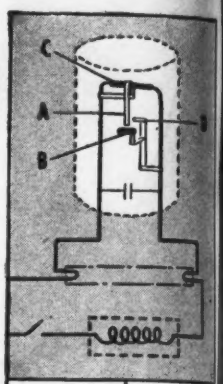
GLOW TYPE

Glass bulb of starter is filled with low-pressure Argon gas. Current makes gas glow, and the resultant heat causes bimetal strip *A* to move over to make contact with *B*, thus preheating the lamp cathodes. This extinguishes the glow in the starter, thus cooling *A* and causing contacts to open. Current then establishes the lighting arc through the fluorescent lamp. Sylvania glow-type starters are manufactured under the name of Glostat, a quick-acting, rugged starter recommended for small and medium-sized fluorescent installations.



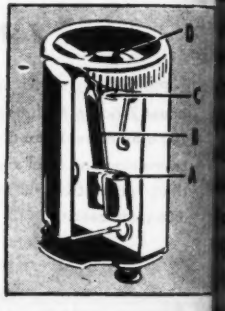
With Lamps of this Wattage	Use Sylvania Glostat Model
30-40	FS-4
15-20	FS-2
4-6-8	FS-5

THERMAL TYPE



With Lamps of this Wattage	Use Sylvania Mirastat Model
15-20	M2
30-40	M4
65	M7
100	M6

In a thermal or resistance-heat-operated starter, when the line switch is closed, the bimetal operating strip *A* is touching carbon contact *B*, thus allowing the current to preheat the lamp cathodes. However, the heat generated by the current at this point of contact causes the bimetal *A* to move away from *B*, thus causing the current to strike the lighting arc. *A* is kept away from *B* by heat generated in resistor *C*, which is subjected to the same voltage as the lamp. In restarting, after a momentary interruption of current, *C* is subjected to full-line voltage, and the additional heat causes *A* to bend until it touches restart contact *D*. This allows current to preheat the cathodes again; but, at the same time, it short-circuits *C*, so that *A* moves away from *D*, causing the current to strike a lighting arc again. The Sylvania thermal-type starter is the Mirastat.



CUT-OUT (PUSHBUTTON) TYPE

When a lamp fails, automatic starters continue to make an effort to light the lamp. This causes blinking, wastes current, and injures the starter and ballast. Where immediate lamp replacement is impractical, use a starter with a mechanism that cuts the failed lamp out of circuit automatically. Cut-out starters are the thermal type with circuit breaker consisti of a small resistor *A*, a bimetal latch *B* as one contact, and a pho phor bronze spring *C* as the other contact. The current pass through these elements, which are held in contact position by t latch. When a lamp fails, heat is generated in *A*, which releases and cuts the lamp out of the circuit. With a new lamp in pla the circuit breaker can be reset by pushing button *D*. Pushbutt starters last five to ten times longer than automatic starters, a they eliminate blinking. They are recommended particularly f large installations where the investment in fixtures and lamps considerable. The Sylvania pushbutton starter is the COP (C Out-Premium), available in model COP-4 for 40-watt lamps.

For additional maintenance information,
SEND FOR THIS FREE BOOKLET ➡

One Standard — The Highest Anywhere Known

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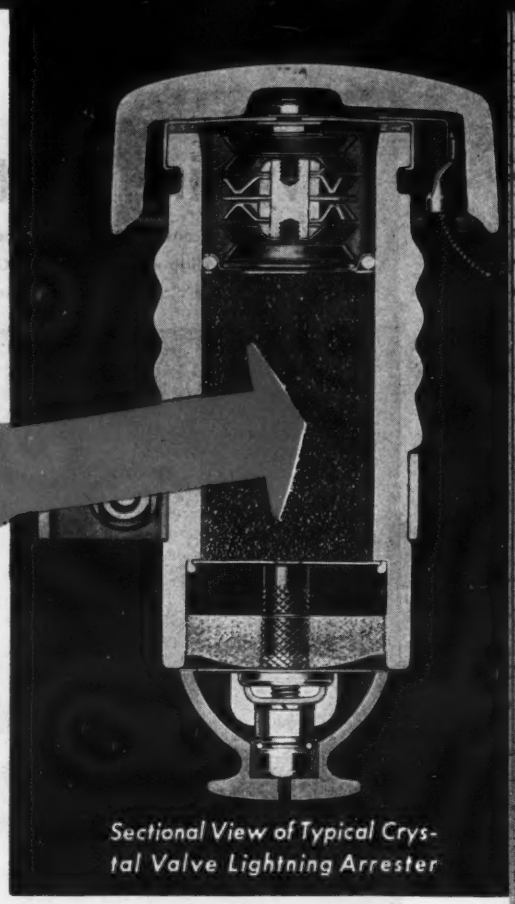
SALEM, MASSACHUSETTS

FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, INCANDESCENT LAMPS, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVI

OXIDIZED Silicon Carbide

TODAY'S MOST HIGHLY DEVELOPED VALVE ELEMENT

Used only and exclusively in Crystal Valve Lightning Arresters



Sectional View of Typical Crystal Valve Lightning Arrester

hat It Is—Initially a specially ocessed type of electrical silicon bide. After crushing, washing, ng, etc., a special high-tempera- chemical treatment provides h crystal with a *thin, porous coat-* of silicon dioxide—SiO_2.

hat It Does—Since it was de- oped exclusively for lightning ar- er usage, its electrical character- cs, such as resistance and valve on, are especially adapted to tning arrester operation. These vide Crystal Valve arresters with:

ow IR voltage drop and ample urge voltage reduction, with ade- uate surge energy absorption.

eavy-duty surge discharge ca- acity.

xtremely marked valve action r follow current interruption.

ong life, since no measurable de- rioration of Crystal Valve arres- rs occurs after years of normal rvice.

No material so far developed for the valve element of lightning arresters has advantages and characteristics as definitely outstanding as does Oxidized Silicon Carbide grain; it is because of this, plus our experience of more than 50 years in the lightning arrester field, that Crystal Valves embody in such marked degree the desirable features of valve type lightning arresters and have therefore afforded such superior protection to equipment and service.

Where arrester performance must be critical and exacting; where it must be depended upon absolutely—the Crystal Valve is definitely indicated.

ELECTRIC SERVICE MANUFACTURING CO.

Former name—Electric Service Supplies Co.

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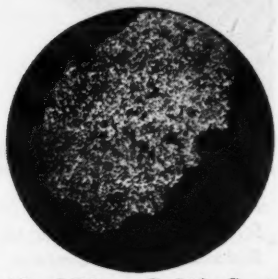
Stocks Located at Strategic Points for Quick Delivery

Illustrated below are Silicon Carbide Grains Enlarged 100 Diameters—but Note the Difference



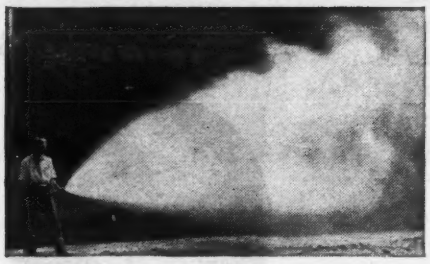
***Oxidized* Silicon Carbide Crystal—a specially processed type of silicon carbide *used only and exclusively,* in discrete form, for the valve element of Crystal Valve lightning arresters.**

Typical Silicon Carbide Crystal—used for many years both in discrete and bonded forms as the material generally used for the valve element of lightning arresters.

CRYSTAL VALVE LIGHTNING ARRESTERS

Navy Fire Fighters use WaterFOG

WaterFOG is one of the new devices used by the Navy in its training schools for fire fighters. High velocity WaterFOG discharged from an SG-40 WaterFOG nozzle shielded these Navy Fire Fighters and quickly extinguished this raging oil fire.



High velocity WaterFOG from an approved SG-40 nozzle designed for the U. S. Navy by Rockwood Sprinkler Company.

* * *

Hundreds of industrial plants also have WaterFOG equipment,—both fixed piping installations and nozzles for hose lines.

What is WaterFOG?

WaterFOG is man-made fog, created by impinging streams of water from specially-designed Rockwood nozzles. It is particularly effective on oil fires, because of its great heat-absorbing area (much greater than in solid stream or spray) and its floating action.

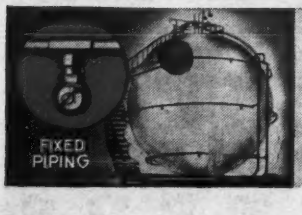
Instead of plunging quickly through the flame into the liquid, thus increasing vaporization — WaterFOG drifts gently into the combustion area, cooling both the burning vapors and the liquid surface, and then changing into steam, cuts off oxygen supply.

Many firms have given up more expensive, less certain fire-fighting methods to return to water. WaterFOG, economical, plentiful, prevents "flashback", saves costly chemicals, lessens water damage and is a non-conductor. Rockwood installations are approved by Underwriters' Laboratories and Factory Mutuals. Write for bulletin 123.

ROCKWOOD SPRINKLER COMPANY
62 Harlow Street, Worcester 5, Mass.
Specialists in Fire Protection Engineering, Equipment and Installation since 1907

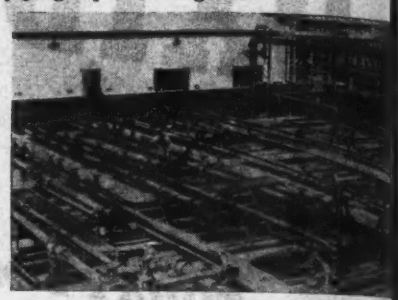
ROCKWOOD WaterFOG

Water Engineered by Rockwood Cools, Confines, Smothers Oil Fires



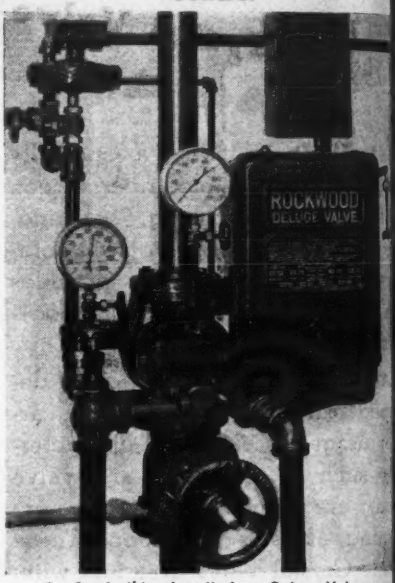
WaterFOG Installation Guards Refinery's Nerve Center

Vital and expensive equipment can be saved from the ravages of flammable liquid fires when a WaterFOG system of fire piping is posted on guard.



For example, the manifold pits shown in the picture are protected by a WaterFOG system controlled by the Rockwood Dualguard Automatic Control.

Rockwood Dualguard Automatic Control



For fixed piping installations. Deluge Valves supply water to the WaterFOG system when automatic equipment detects fire.

Complete fire-protection effectiveness of a WaterFOG system depends upon proper engineering. Such factors as proper spacing of heads, distance between heads and hazards, etc. are important in determining correct particle size, fog pattern and velocity.

For this reason fixed piping installations should be engineered and installed by Rockwood engineers, who are authorities on hydraulics as applied to fire protection.

Typical WaterFOG Applications

- transformers
- oil switches
- generators
- paint shops
- oil storage

etc.

COLORED MOVIE! Executives of firms having flammable liquid hazards are invited to write for a colored movie (16 mm.) showing tests of Rockwood WaterFOG.

Rockwood Sprinkler Company, Worcester 5, Massachusetts.

NO EXCUSES FOR UNNECESSARY OUTAGES

Service Interruptions Mean War Production Interruptions

● You can less afford unnecessary outages today than ever before. Man-power and time of servicing and replacing blown links make this prohibitive.

The elements of S & C Links are designed and constructed of silver, like the time-proven elements used in S & C Power Fuses. They *reduce unnecessary outages* and save time because they have:

- ★ **High surge capacity**
- ★ **Resistance to corrosion and deterioration**
- ★ **Uniform quality**
- ★ **Sustained accuracy of time-current characteristics**
- ★ **Greater mechanical strength**

S & C Universal Silver Fuse Links will save man-hours, truck-miles, and customer complaints. Can be used in all manufacturers' cutouts. Deliveries made from stock.

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Manufactured in Canada by Powerlite Devices, Ltd., Toronto, Ontario

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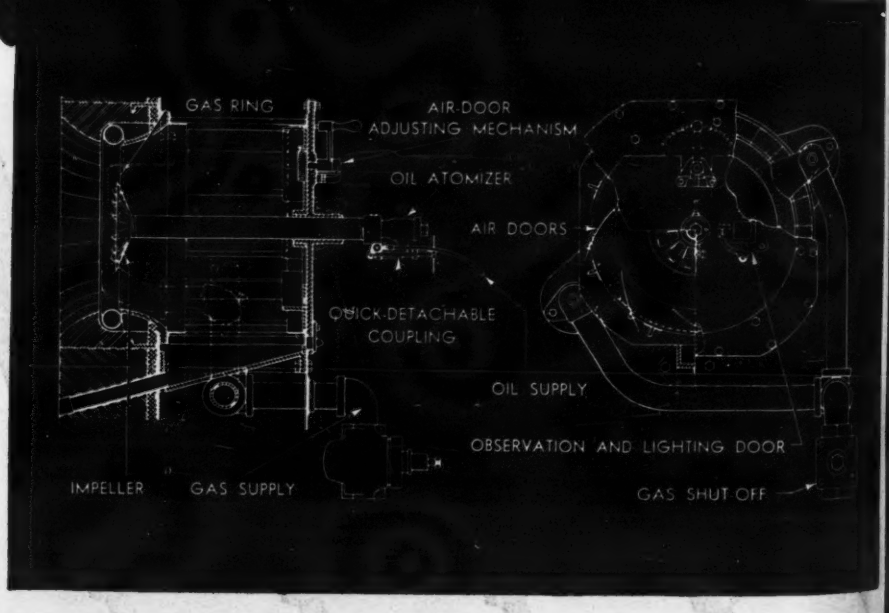
supplies steam at



Combination fuel gas and oil burners of this type are installed on boilers at Lake Charles.

View of Topping Units (right) and three Cracking Units (left) at new Lake Charles plant of Cities Service.

Lake Charles

Six Babcock & Wilcox boilers help to provide power and process steam for the new giant Cities Service refinery at Lake Charles, Louisiana. Two are the B&W Integral-Furnace type, and teamed with them are 23 B&W burners on these and other boilers in the plant.

Providing tankfuls for task fliers calls for uninterrupted production . . . makes "steam up" as important as "on stream" . . . demands a high standard of efficient performance from generating equipment. B&W Integral-Furnace Boilers are a "known quantity", proved dependable in war industries as in pre-war services . . . now serving steel mills as well as refineries; arsenals and aircraft factories as well as butadiene plants.

Experience gained in unprecedented war-time assignments added to years of steam progress, will be reflected in the service of B&W Integral-Furnace Boilers to post-war industry.

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THE BABCOCK & WILCOX CO.

BUY MORE WAR BONDS

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The BETTER

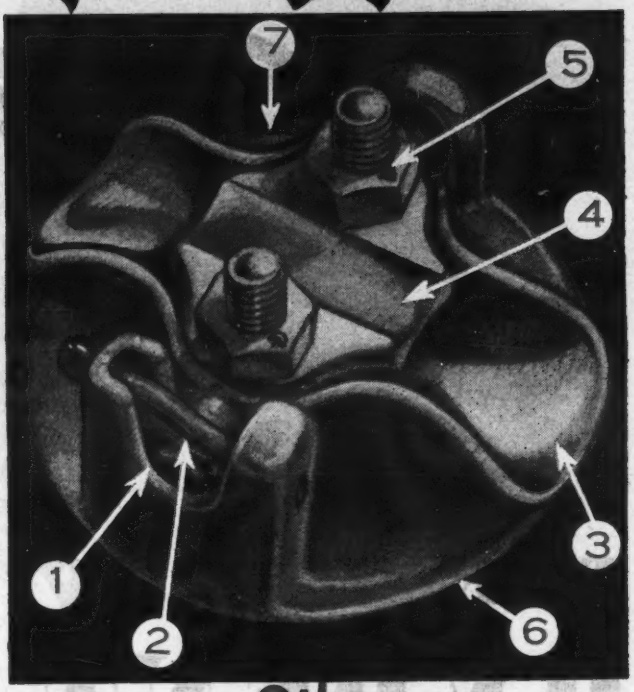
ORIGINATOR AND LARGEST MANUFACTURER OF WET-PROCESS PORCELAIN INSULATORS

LOCKE INSULATOR

FIRST IN CLAYRAMICS

Locke Clamp-Types

GIVE YOU THESE EXCLUSIVE ADVANTAGES



Eliminate Radio Interference

permanently. All metal parts are in initimate electrical contact at all times and under all conditions.

Conductors Are Protected

against burning. The heavy clamp mounting definitely keeps power arcs away from the easily damaged conductor.

No Loose Parts To Handle

in the air. The insulator minus the clamp is installed just as you would install any other pin type insulator. The clamp is attached loosely to the conductor on the ground. It is only necessary when installing the conductor to slide the clamp into its proper location, drop it into the mounting, drive home the cotter key and tighten the bolts.

No Special Tools

are required either to install or replace an insulator. Hot line maintenance is simple and fast using nothing but standard tools.

Other Valuable Features . . . .

1. High trunnion seat to permit maximum free clamp movement.
2. Heavy duty cotter key maintains electrical contact with the trunnion at all times. It cannot be completely removed, but is easily withdrawn to permit removal of clamp.
3. Wide, smooth bell mouth to eliminate conductor chafing.
4. Reversible keeper to accommodate maximum number of conductor sizes. Holds the conductor gently and firmly without danger of crystallization.
5. Special lock-nuts to prevent loosening of grip in service.
6. Overlapping cap protects cement joint from action of weather.
7. Smooth rounded edges to retard corona formation.

Only LOCKE clamp-types give you all these advantages

For nominal ratings from 34.5 KV to 69 KV, these better, time-saving units are available in either standard multipart or Hi-Top type.

Before you decide on the insulators for your next construction job, be sure to get all the details on Locke Clamp-Types.

FIFTY PROGRESSIVE YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

LOCKE CORPORATION BALTIMORE MARYLAND

FIRST IN CLAYRAMICS

TIME-TE

1937
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THE Burndy HYDENT CONNECTION

Right from the start . . . the simplicity, the efficiency, and the economy, of the HYDENT connection has been acknowledged.

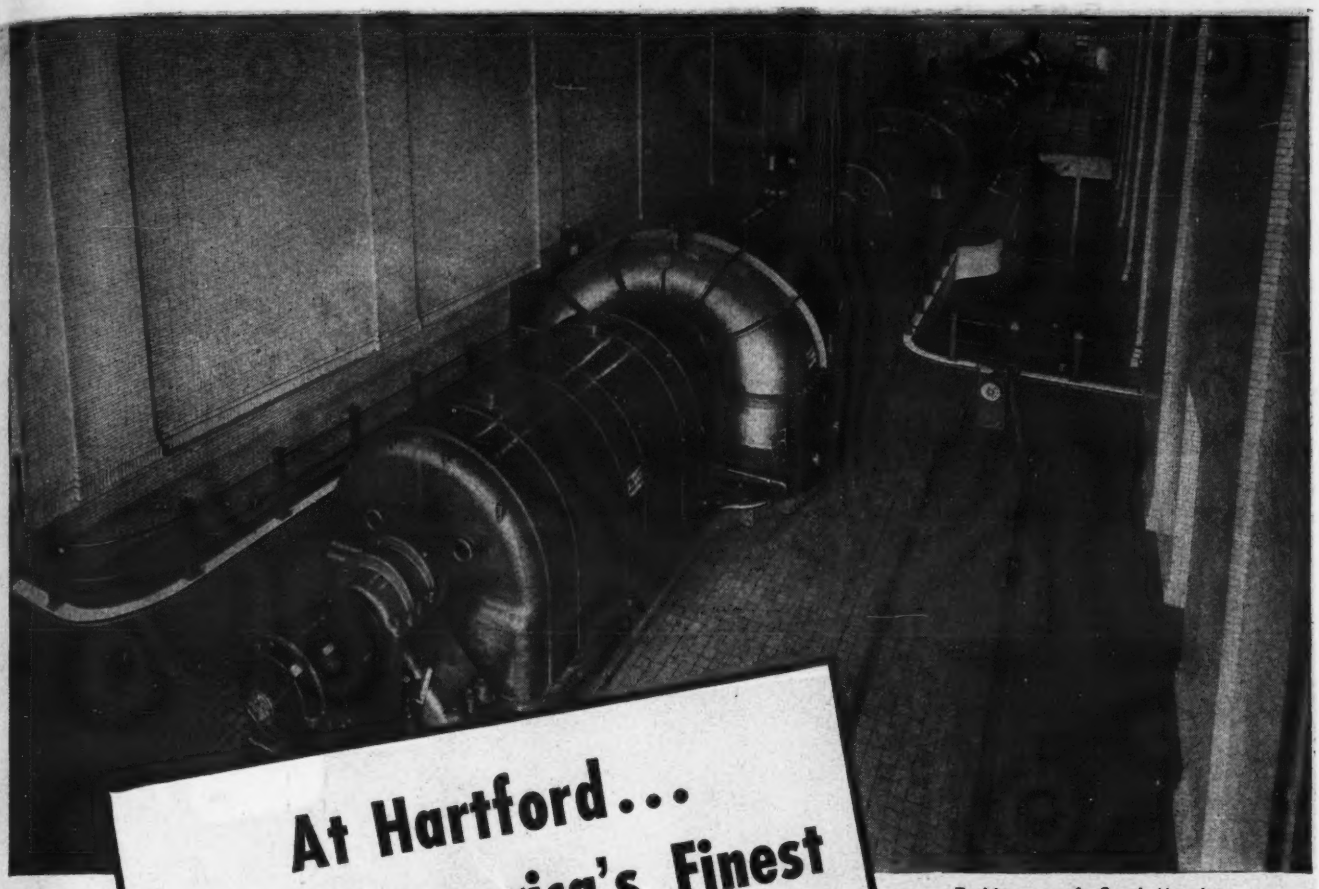
During the past 8 years, too, there has been furnished overwhelming evidence of its unequalled *permanency.* Overhead, underground, and in circuits and equipment of all kinds, millions of HYDENT connections have "held fast" under all service conditions. For indenting with the Burndy HYTOOL compresses connector and conductor into one *integral* unit . . . *a connection that is truly permanent.*

With its permanency thus proved in actual operation, isn't it now time to take advantage of the big economies which HYDENT connectors provide? Available as HY-LUGS, HYLINKS, HYTEES, HYCRABS and others. Write for complete information . . . Burndy Engineering Co., 107 Bruckner Boulevard, New York 54, N. Y.

IN CANADA: Canadian Line Materials, Limited, Toronto 13

Headquarters for CONNECTORS

Burndy



At Hartford... One of America's Finest Equipped Central Stations

Turbine room in South Meadow Station of The Hartford Electric Light Company, Hartford, Conn.

The fact that Exide Batteries are used to power the control bus by The Hartford Electric Light Company has special significance, for the station operated by them is recognized throughout the industry as one of the most modern and finely equipped in America.

From the time of their establishment, in 1882, they have been pioneers in adopting new methods of generating and distributing electrical energy. They were the first public utility in America to transmit three-phase alternating current at high voltage for any considerable distance . . . the first to use steam turbines to drive the generators. To these may be added other important "firsts" which eventually became standard practice.

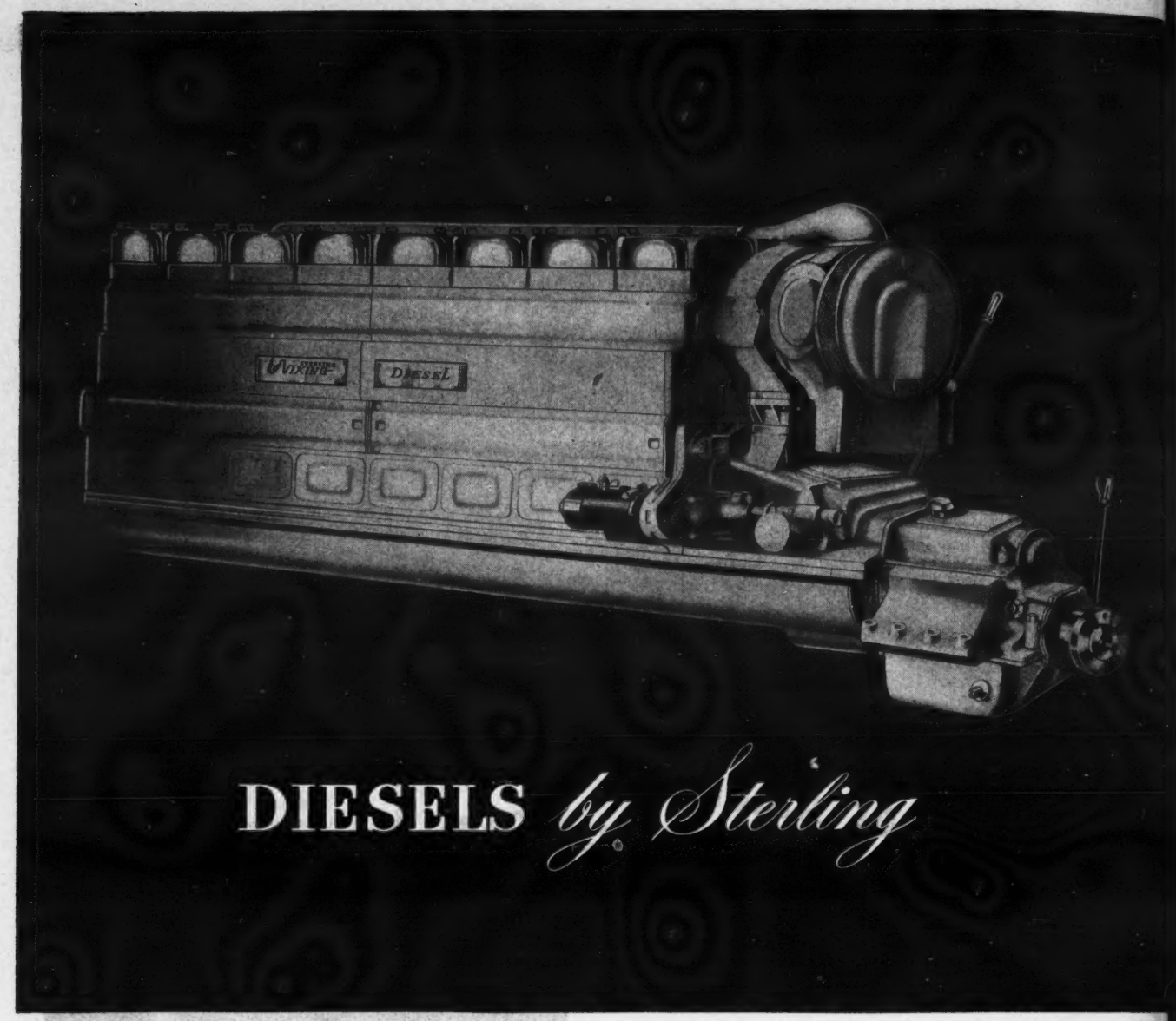
Exide makes several types of storage batteries for control bus operation. These batteries have earned the confidence of engineers everywhere, and their widespread use in public utilities and private industrial plants is proof of their dependability, long-life, and ease of maintenance. When you buy an Exide, you *Buy to Last.* Take care of it, and *Save to Win.*

ARMY E NAVY

Exide BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32

Exide Batteries of Canada, Limited, Toronto



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★ *The achievement of*

40 years building quality engines for marine and industrial use

● For many years before Pearl Harbor Sterling engineers were experimenting on a new type diesel engine—a medium duty power plant combining the compactness of a gasoline engine with the efficiency of diesel operation and the economy of diesel fuel.

Now ready for delivery is their achievement—the new Sterling Viking diesel. Here is a compact medium duty power plant rugged enough to give heavy duty performance—yet it operates on two-thirds or less the amount of fuel consumed by a gasoline model of similar rating.

If you are replacing your present power plant or laying plans now for present or future needs, Sterling engineers will be glad to cooperate in furnishing full information for installing the new Viking diesel. Write us for details.

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Sterling engines... diesel, gasoline or gas—in marine and stationary models... are now available in horsepowers from 85 to 1200.

SPECIFICATIONS . . . STERLING VIKING DIESEL

Supercharged and Unsupercharged—6 and 8 cylinder

HORSEPOWER RATINGS AND WEIGHT

	6 CYLINDER *Unsupercharged*	6 CYLINDER *Supercharged*	8 CYLINDER *Unsupercharged*	8 CYLINDER *Supercharged*
CONTINUOUS	275 HP @ 1000 RPM	410 HP @ 1000 RPM	365 HP @ 1000 RPM	550 HP @ 1000 RPM
INTERMITTENT	325 HP @ 1200 RPM	495 HP @ 1200 RPM	440 HP @ 1200 RPM	650 HP @ 1200 RPM
WEIGHT WITH REVERSE GEAR	8,000 pounds	8,500 pounds	10,000 pounds	10,500 pounds
WEIGHT WITH REVERSE AND REDUCTION GEAR	10,000 pounds	10,500 pounds	12,000 pounds	12,500 pounds

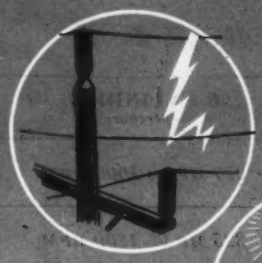
ENGINE CONSTRUCTION

Cylinder Block: Cast iron enbloc construction. Removable cylinder liners. *Crankshaft:* Counterbalanced 6″ main journals and 5″ crankpins. Crankshaft drilled for full pressure lubrication. *Connecting Rods:* Forged steel, rifle drilled for pressure lubrication to piston pin. *Camshaft:* Located in cylinder block. Removable from side of engine. *Bearings:* Main bearings, connecting rod bearings and camshaft bearings are precision type steel backed. *Pistons:* Cast aluminum alloy, provided with six rings and full floating piston pin. *Valve Mechanism:* Dual intake and exhaust valves actuated by hydraulic lifters through push rods and rocker arms. *Timing Gears:* Helical gears located at forward end of engine. *Reverse Gear:* Bevel planetary type, manual or remote control. Thrust bearing located in after end of reverse gear housing. *Lubrication:* Pressure lubrication to all moving parts. Dry sump. Separate gear driven positive displacement pressure and scavenge pumps. *Cooling System:* Fresh water cooling. Separate gear driven self-priming centrifugal fresh water and sea water pumps. *Fuel Injection System:* Individual cam operated pumps. Nozzles located in center of cylinder heads. Fuel transfer pump gear driven positive displacement. *Supercharger:* Exhaust driven, located at after end of engine. Water-jacketed exhaust manifold. *Governor:* Hydraulic variable speed. Provision is made for remote control. *Starting System:* Two electric starting motors. Gear driven generator for battery charging. *Tachometer and Revolution Counter:* Gear driven electric tachometer and mechanical revolution counter.

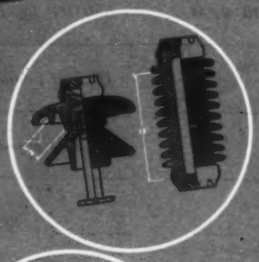
"KEEP BUYING WAR BONDS"

If you have insulator failures FROM ANY OF THESE CAUSES:

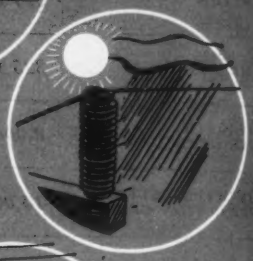
POWER ARCOVER



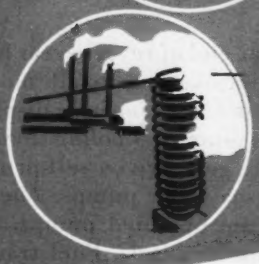
PUNCTURE



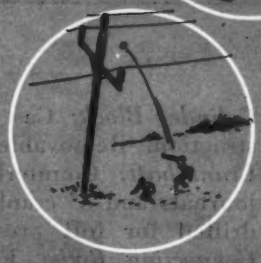
CRACKING



ATMOSPHERE CONTAMINATION

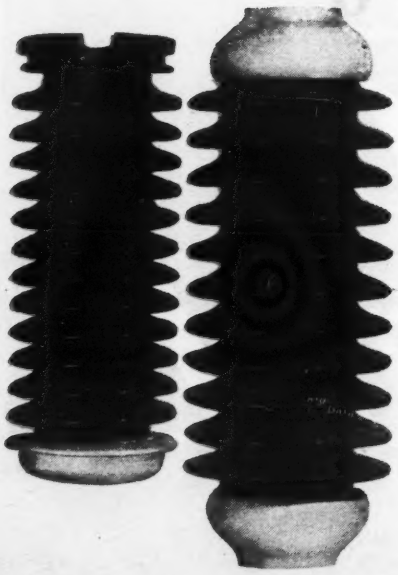


MECHANICAL ATTACK



You Need Lapp Posts!

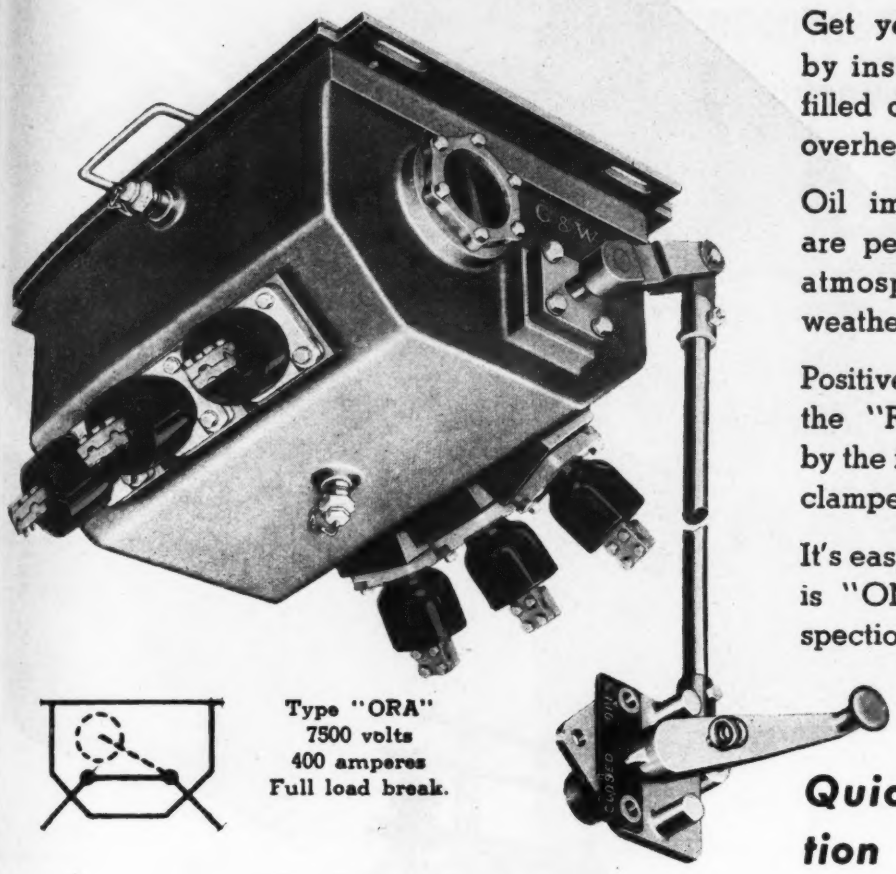
• Looked at from a dollars-and-cents viewpoint—or in terms of man-hours of under-staffed and over-worked patrol and maintenance crews—Lapp Line Posts and Station Posts are smart business. For the engineering achievement of these insulators—now proved by more than 12 years of service in the toughest areas—is that of eliminating at their source *all* the common causes of high-voltage insulator failure. A one-piece post body, with multiple short rugged petticoats, this Lapp design is proof against puncture and cracking, is capable of withstanding enormous shock from power arcover or mechanical attack, provides uniform leakage path for operation under dirt conditions. For replacement, new construction or line conversion, Lapp Posts on your transmission lines and substations will give better performance and less trouble.



Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N.Y.

Use G&W Type "RA" Oil Switches on pole-tops, too!



Type "ORA"
7500 volts
400 amperes
Full load break.

Get years of trouble-free service by installing metal-enclosed oil-filled disconnects for sectionalizing overhead circuits.

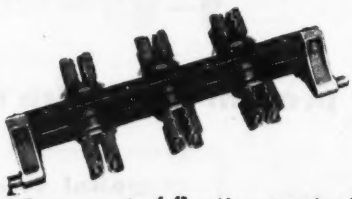
Oil immersed contacts and links are permanently protected against atmospheric corrosion and bad weather conditions.

Positive oil-tightness is assured by the "Rotary Oil Shaft Seal" and by the individually tapered gasketed clamped porcelain bushings.

It's easy to check whether the switch is "ON" or "OFF" by visual inspection through the large window.

Quick and safe operation from ground level.

ROCKER ARM LINKS:



Floating contact links are encased in porcelain bushings which are in turn clamped in impregnated wood straps fitted with crank arms at the ends.

The shafts are in line with one set of floating contacts about which the rocker arm assembly pivots. One shaft extends through a Rotary Oil Seal to the external operating lever. The other shaft is set in a babbitted bearing on inside tank wall.

Using proper cableheads, welded tanks and standardized rocker arm assemblies, many forms of enclosed disconnects are regularly being made to meet a large variety of sectionalizing problems.

Write us or our nearest representative for further data.

G&W ELECTRIC SPECIALTIES

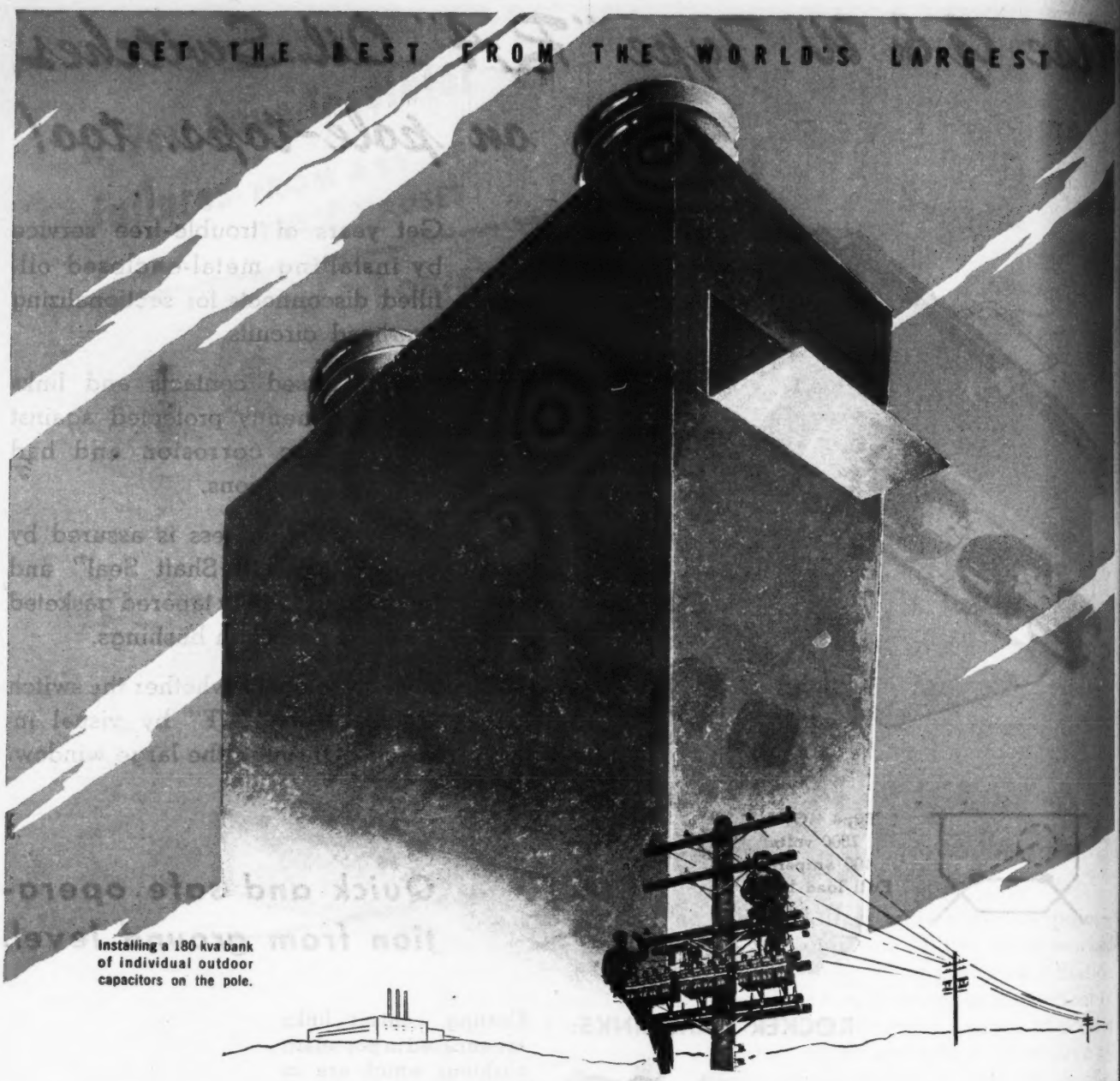
Originators and pioneers of equipment for sound methods of underground and overhead electric distribution.

G&W ELECTRIC SPECIALTY CO.

7780 DANTE AVE., CHICAGO 19, ILL., U. S. A.

Also made in Canada by Powerlite Devices, Ltd., Toronto

Potheads . . . Boxes . . . Oil Fuse Cutouts . . . Oil Switches . . . Multiple Circuit Disconnects



Installing a 180 kva bank of individual outdoor capacitors on the pole.

MORE LOAD CURRENT on your present lines with C-D capacitors

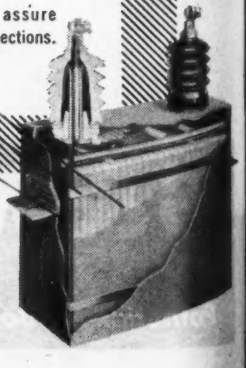
Easy to install and easy to re-locate when loads change, C-D Capacitors enable you to gain capacity anywhere on your system quickly and inexpensively without adding new feeders or substation equipment.

Electric service companies everywhere are installing C-D Capacitors as a low-cost means of gaining needed capacity. A typical application is this substation installation of 15KVA, 2400 volt individual C-D Capacitor units.

Look into the advantages of C-D Capacitors for your system. Your local C-D field engineers will be glad to give you full information. Write today to Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

3 typical Cornell-Dubilier extra quality features

1. Stacking of sections is uniform.
2. Sturdy steel tension bands equalize pressure throughout capacitor.
3. Compact rigid end plates assure uniform pressure on stacked sections.



CORNELL-DUBILIER CAPACITORS

FOR POWER FACTOR IMPROVEMENT • CARRIER CURRENT COUPLING • SURGE PROTECTION

FWD TRUCK-POWER

Overcomes Handicaps of Manpower Shortage

This FWD established an enviable record for Los Angeles' Bureau of Power & Light, by restoring power after floods tore down transmission line towers.

MORE customers to serve . . . and more service per customer . . . with less man-power, restricted materials and limited equipment! . . . and still America's public utilities are coping successfully with these unprecedented service loads.

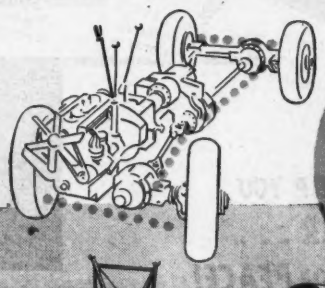
FWD truck-power is being employed by more than 150 utilities to help overcome handicaps of man-power shortage. Fleets of FWDs are proving that they have the ruggedness, four-wheel-power and traction to go "beyond the limit" of average contemplated service. Thousands of FWDs in utility duty are putting their "extra bit" into every emergency or routine duty to keep the pledge of public utilities in rendering service "as circumstances demand". In any weather, over any road, "more power" to the utilities that have built their service soundly around FWDs!

THE FOUR WHEEL DRIVE AUTO CO., Clintonville, Wisconsin

Canadian Factory: Kitchener, Ontario

Four-Wheel-Drive . . . THE BACKBONE OF RUGGED, DEPENDABLE TRUCK HAULING POWER

The true application of four-wheel-drive with center differential provides ability to get through under difficult conditions — increased surety and safety on the road — lower operating cost per ton-mile — long service life.



ARMY NAVY

FWD TRUCKS

COMMERCIAL

CONSTRUCTION

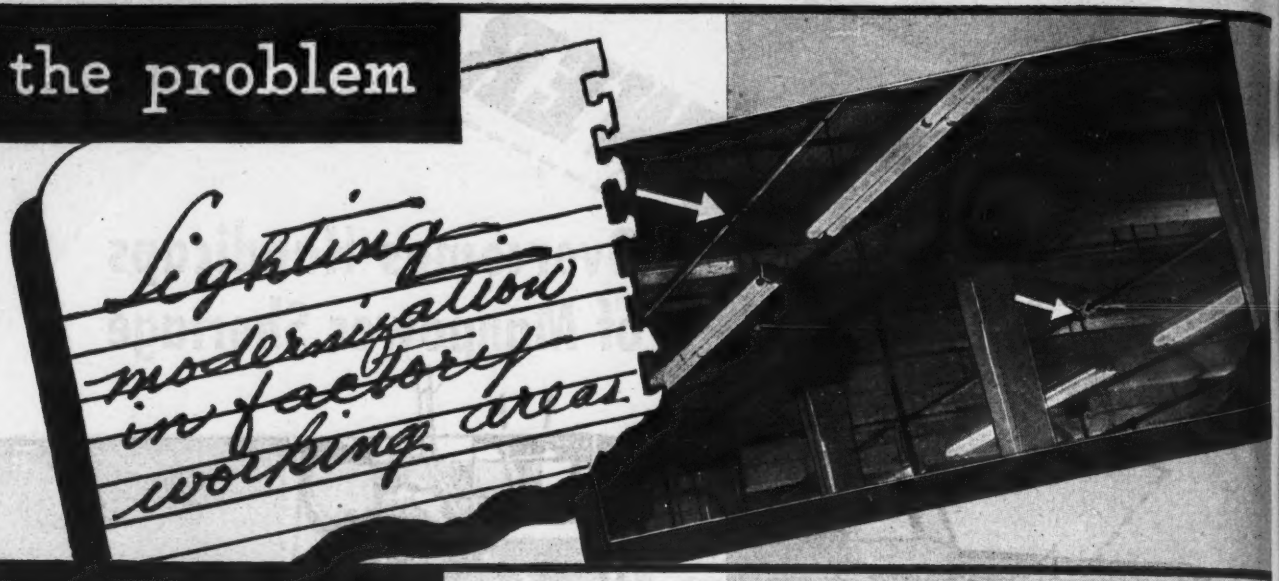
UTILITIES

OIL FIELDS

MILITARY

Trade-Mark of the Original and Exclusive Builders of Four-Wheel-Drive Trucks.

the problem



the answer

WIREMOLD SIMPLIFIED, FUNCTIONAL WIRING METHODS

CAPACITY: Without Receptacles, up to 10 No. 12 R.C. Conductors. With Receptacles, up to 6 No. 12 R.C. Conductors.

● Versatile and widely adaptable Wiremold methods save time and money and assure the efficiency of the finished job. Here, for example, Wiremold No. 2100 Plugmold, spanning overhead beams, has been used as a complete wiring system for industrial fluorescent units. Connections to lighting units are made by simply plugging in to the Plugmold, greatly simplifying maintenance of fixtures.

Similar time and cost saving ideas are constantly being developed by Wiremold engineers and contractors.

Write for latest Industrial Bulletins and Data Sheets.

WIREMOLD CAN HELP YOU PRODUCE FOR WAR . . . WHILE YOU PLAN FOR PEACE!

KNOW YOUR

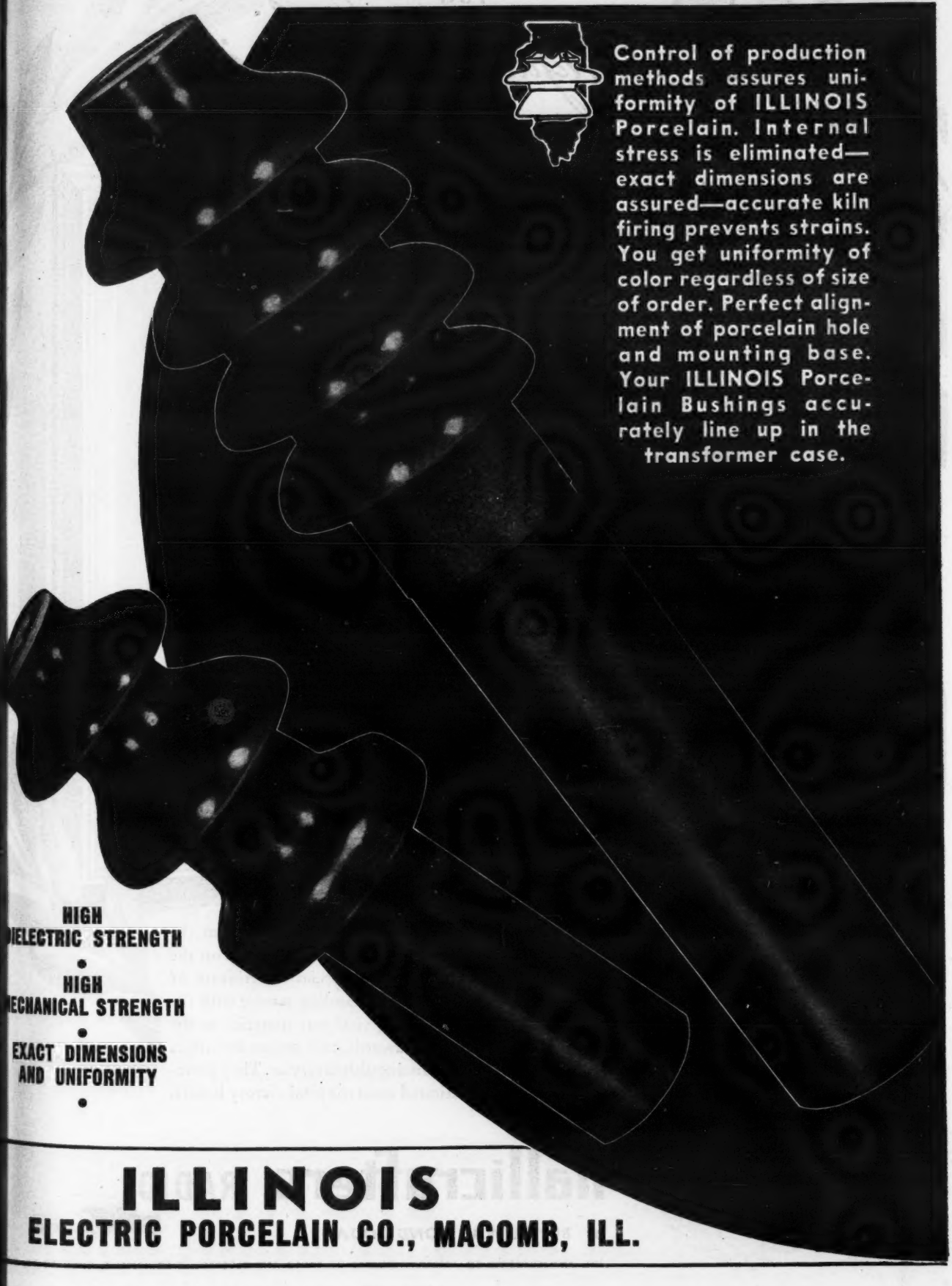
WIREMOLD

AND YOU KNOW THE ANSWERS

THE WIREMOLD COMPANY, HARTFORD 10, CONN.

You Get Uniformity In
ILLINOIS PORCELAIN BUSHINGS

Control of production methods assures uniformity of ILLINOIS Porcelain. Internal stress is eliminated—exact dimensions are assured—accurate kiln firing prevents strains. You get uniformity of color regardless of size of order. Perfect alignment of porcelain hole and mounting base. Your ILLINOIS Porcelain Bushings accurately line up in the transformer case.



HIGH DIELECTRIC STRENGTH

•

HIGH MECHANICAL STRENGTH

•

EXACT DIMENSIONS AND UNIFORMITY

•

ILLINOIS
ELECTRIC PORCELAIN CO., MACOMB, ILL.

FOR *Distinguished Service* AGAIN!

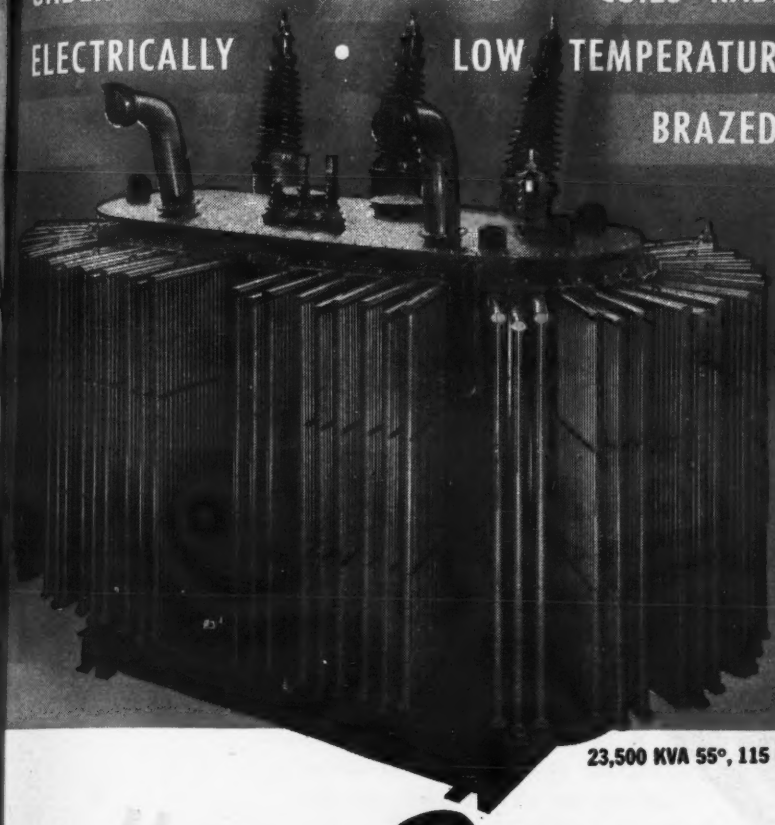
Men and women of Hallicrafters are privileged to receive from the United States Navy further recognition for distinguished service on the war production front. They have been given a special "Certificate of Achievement" — first award of its kind — for outstanding service with the radio-radar industries of Chicago in speeding vital war material to the Navy. Added to the four Army-Navy "E" awards, this makes five times Hallicrafters workers have been cited for distinguished service. They promise that this kind of service will be continued until the total victory is ours.

hallicrafters RADIO

★ **BUY A WAR BOND TODAY**

THE HALLICRAFTERS CO., MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT, CHICAGO 16,

CIRCULAR COILS, PRECOMPRESSED AND LOCKED IN PLACE, PREVENT MOVEMENT UNDER SHORT CIRCUIT STRESS • COILS RADIALLY AND AXIALLY BALANCED ELECTRICALLY • LOW TEMPERATURE VARNISH IMPREGNATION • BRAZED CONNECTIONS • STRAIGHT LINE TAP CHANGERS • HEAVY GAUGE RADIATORS • HIGH PRESSURE RADIATOR TESTING • FLEXIBLE EXPANSION TANK CONNECTORS • BASE CONSTRUCTION PERMITS 4-DIRECTION MOVEMENT • COVER, CORE AND COIL REMOVABLE AS A UNIT • ETC.



23,500 KVA 55°, 115 KV 3-phase

Pennsylvania Power Transformers incorporate all the factors for outstanding performance*

Feature by feature, Pennsylvania Power Transformers are equal to any and superior to many. But when you buy Power Transformers you are not buying individual features, specific gadgets or trimmings. You seek overall *performance** . . . resulting from a *combination* of *all* factors necessary to produce maximum *effective operation.*

This combination entails three prime requisites:—(1) sound, advanced engineering design, (2) top quality materials and (3) adequate plant facilities coupled with skilled craftsmanship. *Pennsylvania* has "all three."

Power Transformers are built to rigid specifications. *Pennsylvania's* ability to fulfill the most exacting requirements has been demonstrated by the successful manufacture of transformers as large as 30,000 KVA and 165,000 V; the largest air cooled Welding Transformers ever made; some of the largest Furnace Transformers in existence; and the development of transformers with underload tap changers.

Pick Pennsylvanias for performance.

* **PERFORMANCE—the execution of the functions required; effective operation.**
—Webster

Pennsylvania Transformer Company

808 RIDGE AVENUE N. S. PITTSBURGH 12, PA.

Pennsylvania TRANSFORMERS

When ignorance is blistered!

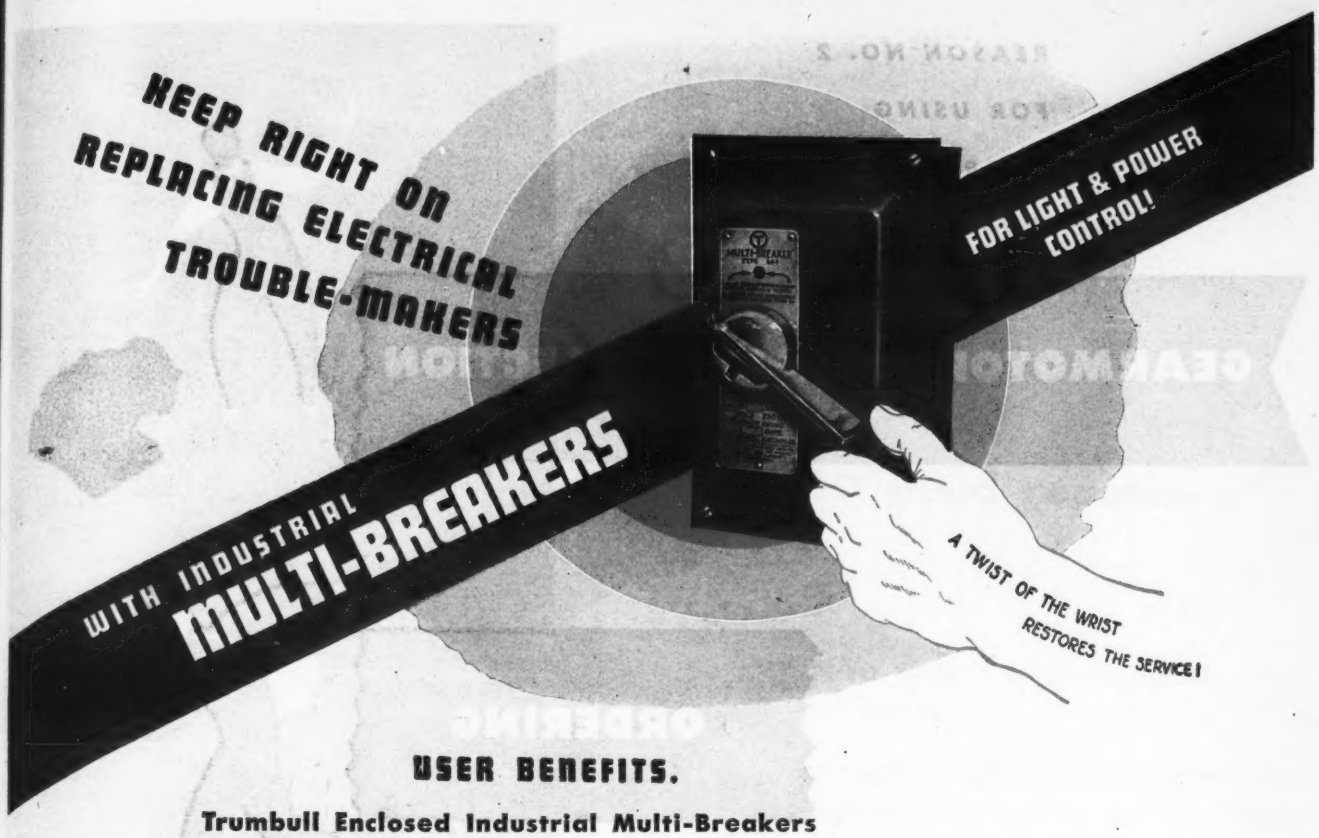
● It's the ignorant men who make costly mistakes. Trained men don't get hurt by small fires. Trained fire-fighters don't let little blazes grow into big ones.

The way to train workers in fire extinguishing is by demonstrating use of extinguishing equipment. Show how to handle real fires. Show how various types of extinguishers are handled on different kinds of fires.

Walter Kidde & Company has prepared a booklet—"How To Teach Fire-Fighting." It tells how to stage a fast-moving, interesting, instructive fire class. Write for your plant's copy.

Walter Kidde & Company, Inc.
140 Cedar Street **NEW YORK 6, N. Y.**

Kidde PROTECTS LIVES
HIGH PRESSURE GASES · FIRE PROTECTION



USER BENEFITS.

Trumbull Enclosed Industrial Multi-Breakers provide automatic overload and short circuit protection for vital light and power services, (Alternating Current up to 100 Amp. maximum) at a price comparable with fusible equipment.

They are intended for same purposes as more expensive "AT" Circuit Breakers . . . within the range of their ratings.

These Heavy Duty Multi-Breakers prevent unnecessary production delays, because after short circuit has been removed, there is nothing to replace or renew. Service can be restored immediately by simply throwing handle to "off" and then to "on" position.

Equipped with thermal trip, providing accurately calibrated time-delay on small overloads, supplemented by magnetic trip, providing instantaneous operation on short circuits and high overloads. They eliminate maintenance problems and are real time and trouble savers.

Write for Trumbullaid Circular 333 giving full details and specifications.

Availability

Available in two sizes for 230 V. AC only. 2 and 3 pole.

Common Trip

Type M-1, 50 Amp. frame size, rated 15 to 50 Amps.

Type M-2, 100 Amp. frame size, rated 50 to 100 Amps.

Quick-Make and Quick-Break; Trip Free Operation. Current interrupting capacity 5000 Amps., R.M.S. at 230 V. AC.

ENCLOSURES are dust-resisting . . . equipped with external front operated self-indicating handle, which can be padlocked in "on" or "off" position. Furnished for surface mounting only. Finish: Baked machine gray enamel.

ELECTRICAL CONTROL APPARATUS

Safety Switches and Circuit Breakers . . Service Equipment . . Motor Control . . Control Centers . . Panelboards . . Switchboards . . Feeder Distribution Systems, etc.

TRUMBULL

ENCLOSED INDUSTRIAL MULTI-BREAKERS

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY • PLAINVILLE, CONN. • A GENERAL ELECTRIC ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES

REASON NO. 2

FOR USING

GEARMOTORS

GEARMOTORS SIMPLIFY SELECTION

Now—you can select and order a slow-speed drive . . . complete and ready to use . . . as easily as an ordinary motor *alone*. The gearmotor is the answer. You can forget center distances . . . pitch diameter and bore of sheaves . . . gear guards, adjustable bases . . . and all the complicated data and figuring you have to worry through in ordering other slow-speed drives.

The gearmotor combines prime mover and speed reducer in a single compact unit . . . motor and gears are *matched* to the job.

Because you spend much less time selecting and ordering the *right* speed reduction equipment—the gearmotor gets onto the job and into production sooner.

Ask your Westinghouse representative about this and many other basic gearmotor advantages. All of these are discussed in detail in new gearmotor handbook, "Gearmotor Applications". A copy will be sent on request. Ask for B-3218. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-07219

REASON NO. 1—GEARMOTORS SAVE SPACE

Third of a series sponsored by Westinghouse to promote the use of gearmotors.

The New Westinghouse

PLANTS IN 25 CITIES — OFFICES EVERYWHERE

WHY USE WESTINGHOUSE GEARMOTORS?

. . . check these 10 good reasons

1. FEWER PARTS TO WEAR. The simple, efficient, design uses a minimum of moving parts.

2. BPT "TOUGH-HARD" GEARS AND PINIONS. This exclusive Westinghouse heat-treating method "tough-hardens" teeth for maximum resistance to shock and impact—means longer wear.

3. USE ALL WESTINGHOUSE MOTOR TYPES—open . . . totally-enclosed . . . splashproof . . . explosion-proof—to meet changes in operating conditions quickly and easily.

4. INTERCHANGEABILITY OF PARTS between unit types reduces your parts' replacement stock by 40%.

5. HIGH EFFICIENCY of gearing parts assures full motor horsepower at output shaft . . . only 2% power loss per gear set.

6. POSITIVE LUBRICATION of gears and bearings by automatic splash system reduces probable maintenance to twice-a-year change of oil.

7. EASY ACCESSIBILITY. Gearing parts can be readily inspected or easily removed to make gear ratio changes.

8. IMPROVED FOUNDATION STABILITY. Feet are under the gear case . . . placing support next to the gearmotor load. Each foot is reinforced by external ribs.

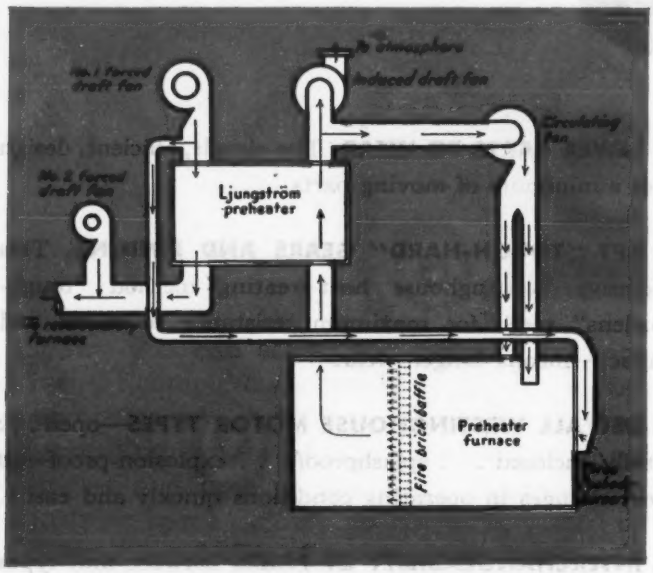
9. UNIT RESPONSIBILITY for design . . . manufacture . . . and service. Westinghouse builds both motor and the gears.

10. MEET A.G.M.A. STANDARDS. The new Westinghouse Gearmotors are specifically designed and built to meet A.G.M.A. standards . . . easy to order and match to the job.

COPPER SMELTING AT CHINO STEPPED UP BY PREHEAT ENGINEERING

Another NEW APPLICATION FOR LJUNGSTROM AIR PREHEATER

The following excerpts from an article appearing in *Engineering and Mining Journal*, July, 1944, tells our story better than we can.



"Use of preheated air in the reverberatory furnace of a copper smelter burning natural gas or oil as fuel is distinctly a new development, despite the fact it has already found wide application in power generation in steel, cement, lime and numerous industrial plants. The air preheater recently installed at Kennecott's Chino smelter, Hurley, N. M. is perhaps the first of its kind on the American continent . . . The furnace is 32 x 126 feet.

"The results are demonstrating clearly the advantages which may be derived from preheated air. Chief among these advantages is that of improved combustion, resulting in higher over-all efficiency.

"The layout of the air preheater service the reverberatory furnace is shown in the drawing. As will be noted, it consists of a separately fired preheater furnace, and the preheater proper, with fans and control equipment. *The preheater is a Ljungstrom* 19½-V-72 unit, employing the continuous regenerative principle. Its rated capacity is 53,000 C.F.M., the air being received at 60 deg. F, 24.45 in. of mercury, and heated to 926 deg. F.

"In the Chino reverberatory furnace operations, improved combustion has resulted in higher temperatures in the interior of the furnace, consequently bringing about more rapid smelting of the furnace charge."

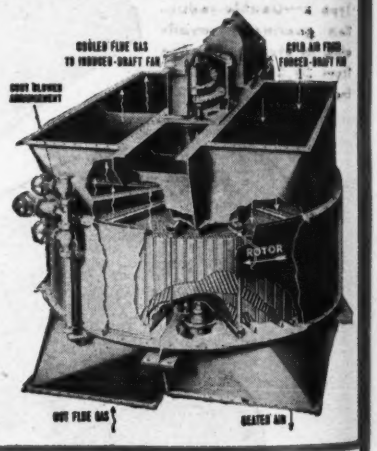
ENGINEERING SERVICE

The engineering staff of the Air Preheater Corporation is prepared to assist you in applying standard or special types of Ljungstrom Preheaters to your fuel conservation needs, or to help you and your engineers make better use of low-grade, more abundant fuels.

THE LJUNGSTROM AIR PREHEATER

The heating surface is contained in a compact, slowly rotating cylinder. Soaking up heat from the hot flue gases, it then rotates to a chamber where it liberates the heat into incoming combustion air.

This continuous, regenerative, counterflow principle assures maximum heat transfer with minimum weight and size. Generally, the Ljungstrom weighs less than half as much as tubular or plate preheaters of similar capacity. With the Ljungstrom, it is possible to obtain preheated air up to 1500 deg. F.



THE
AIR PREHEATER
CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.

How Induction Heating Corporation Puts Electronic Heat on the Production Line

HEAT-TREATING steel in an oven is slow; in a flame, destructive; but put that steel in a high-frequency electric field, and it can soar to red heat in a matter of seconds.

This type of heating—called "electronic" heating when the high-frequency power is generated by electron tubes—has wide application in industry.

In one form (induction heating) it heats metals for hardening, annealing, brazing and soldering operations. It is also used to heat metals sealed within glass. In another form (dielectric heating) it heats wood, paper, glass, ceramics, plastics, foods and chemicals (such as penicillin solution).

Electronic heating can be slow or swift. Heat can be localized, or uniformly distributed. Ovens are eliminated, hence waste heat and time lag required to heat the oven disappear. No flame is involved; surface scale is seldom a problem. Operators work in greater comfort. Heating can be automatically time-controlled to reduce human errors.

Induction Heating Corporation, 389 Lafayette Street, New York City—a leading manufacturer of electronic heating equipment—devised the system illustrated above—wherein a series of steel slugs is fed through a high-frequency coil. Each slug is ⅞ by ⅝ inches diameter—takes just 78 seconds to travel through the coil and to come up to a uniform temperature of 2200° F! Every six seconds a slug comes through—ready for the forging operation which follows. The "Thermonic" unit shown above, built by Induction Heating Corporation for this application, uses RCA power oscillator tubes (type 892) to supply high-frequency power.

Remember...the Magic Brain of all electronic equipment is a Tube...and the fountain-head of modern Tube development is RCA! RADIO CORPORATION OF AMERICA, Tube & Equipment Department, Room 662, Camden, New Jersey.

BUY MORE BONDS... AND KEEP 'EM

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.

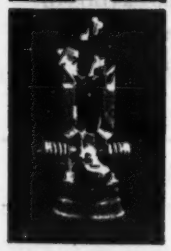
This PACIFIC ELECTRIC Switch Offers

SAFE and SURE OPERATION-

Type TW
7.5 kv. t
220 kv.

1. Closed position. Blade rotated to apply contact pressure.

2. Switch blade rotates to fracture any ice present and to release contact pressure.



3. Blade in partial open position. Arcing horn not shown.

THIS KNIFE-LIKE BLADE ROTATES, FRACTURES ICE, OPENS EASILY

They're well built, that's why these Pacific Electric Switches are safe. You have easy operation because of the knife-like blade that *rotates*, fractures ice and releases contact pressure before opening.

When closing, the blade easily knocks off ice and the twisting motion makes sure, firm contact after the blade has reached the closed position.

The high-pressure contact insures full current-carrying ability and cool operation.

This switch has all the features you have been wanting, including accurate positioning in open and closed position, easy installation and field adjustment, freedom from maintenance, long life, toggle action for positioning of blade on closing without the usual shock of metal-to-metal blade stop, and silver inserts on contacts.

Ask about them, their control mechanism, N.E.M.A. Standards and other features.

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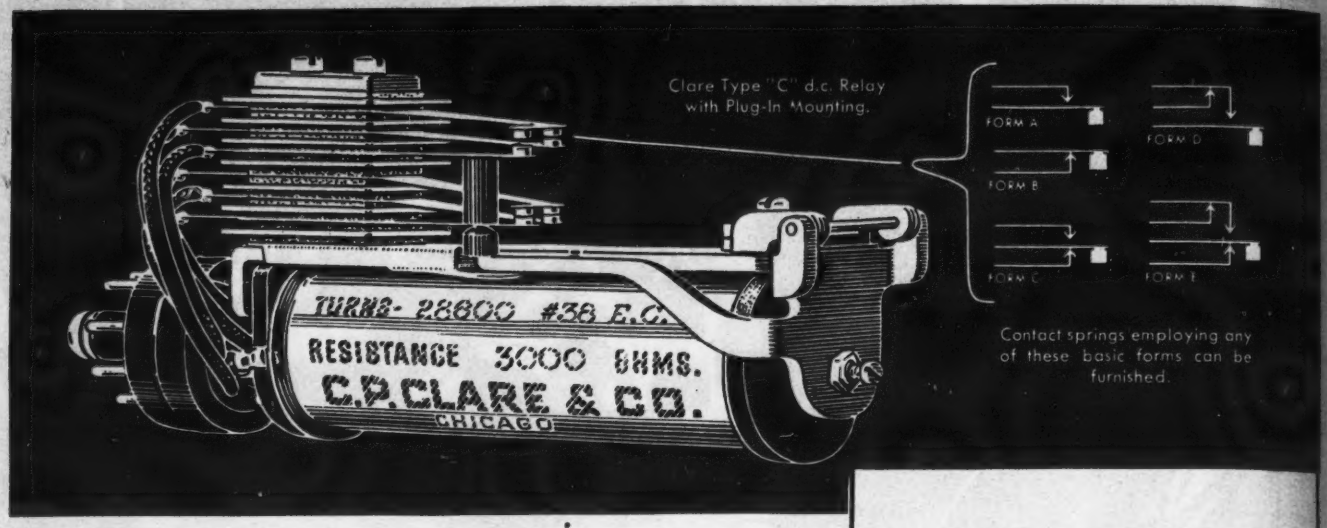

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Under Severe Conditions of Temperature . . . Humidity . . . Atmospheric Pressure . . . Voltage . . . Vibration

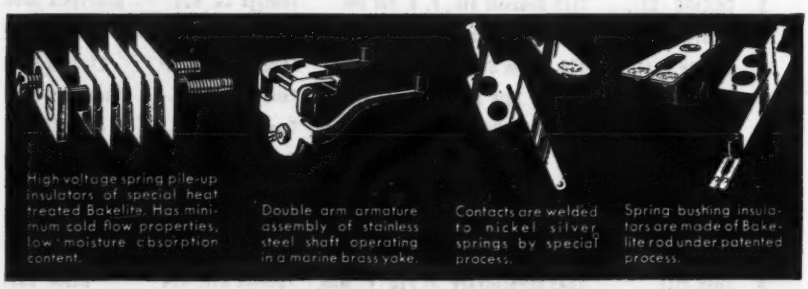
Clare "Custom-Built" Relays offer utility engineers a flexibility of construction and operating characteristics to exactly fit the demands of the widest variety of modern utility uses.

These Clare "Custom-Built" Relays are the product of young-minded thinking . . . of an organization devoted to the manufacture of relays . . . created to free the utility designer from the limitations of ordinary, telephone type relays. Clare "custom-building" selects from a wide range of precisely built materials exactly those most suited to perform the special functions of the application. All Clare Relays are carefully designed, well manufactured from best materials and precisely adjusted for perfect operation.

Does your application call for definite times for operation and release of the relay . . . high speed keying without contact chatter . . . margin operation which may include close pick-up and drop-out values . . . the transfer and switching of high frequency circuits? These and many other special relay functions find Clare Relays give most reliable operation under severe conditions of temperature, humidity, atmospheric pressure, voltage and vibration.

Clare "custom-building" meets these exacting requirements with a design that permits each Clare Relay a wide range of contact ratings . . . choice of five different contact forms or any combination of them . . . either flat or hemispherical contacts of rare metals or special alloys . . . coil windings to match the circuit and application.

Call on Clare to supply a "custom-built" relay exactly suited to your application. Send for the Clare catalog and data book. Address: C. P. Clare & Co., 4719 W. Sunnyside Avenue, Chicago 30, Illinois. Sales engineers in all principal cities. Cable address: CLARELAY.



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Double arm armature assembly of stainless steel shaft operating in a marine brass yoke.

Contacts are welded to nickel silver springs by special process.

Spring bushing insulators are made of Bakelite rod under patented process.

FEATURES OF CLARE RELAYS

Permit exceptional service in those spots where hard usage, long life and absolute dependability are of prime consideration.

1

THE MAGNETIC CIRCUIT

This consists of the heelpiece, armature and coil core, all of the highest quality magnetic iron. After all machining operations are complete, these units are annealed in precision controlled furnaces. The armature assembly is fastened securely to the heelpiece with screw and clamping washer.

2

THE COILS

These are wound on a spool assembly which consists of a coil core equipped with spool heads and acetate or bakelite winding washers. Both coil core and spool heads are insulated from the wiring. Coils are usually wound with enameled copper wire but other types of insulation are used for special applications.

3

THE SPRING ASSEMBLY

This consists of contact springs and insulators assembled to the heelpiece. The assembly is clamped under hydraulic pressure and special high-tensile screws are fastened with a power driver to insure a rigid assembly.

4

THE CONTACTS

Contacts of various materials and sizes are available. These may be of precious metals or alloys, such as silver, palladium-irridium, tungsten and elkonium. Various types can be incorporated in one relay.

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"Custom-Built" Multiple Contact Relays for Electrical, Electronic and Industrial Use

CENTRAL RIGID STEEL CONDUIT

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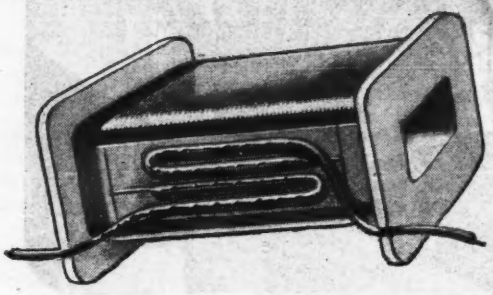
Lumarith*

Electrical Insulation



resists the BLACK HAND OF CORROSION

The logic behind the growing use of Lumarith insulation is extremely simple: The primary cause of the free-acids associated with electro-chemical corrosion is moisture. Lumarith resists moisture, and contains no materials which combine with moisture to form free acids.

Besides, Lumarith doesn't promote that built-in hazard common to much electrical insulation—organic decomposition.

Even where corrosion ordinarily is severe—as with coils on positive D.C. under moisture conditions—Lumarith is dependable. It is outstanding for high dielectric strength and its high softening point (146—177° C. depending on formulation) makes it applicable in many types of coils.

How is Lumarith available? Films, sheets, rods, tubes and molding materials. Films are furnished plain or with special mat finish, easy to see and slippage-resistant—advantages winders appreciate.

You'll want a copy of "Lumarith for the Electrical Industry." Send for it now. Celanese Celluloid Corporation, a *division of Celanese Corporation of America*, 180 Madison Avenue, New York 16, N. Y.

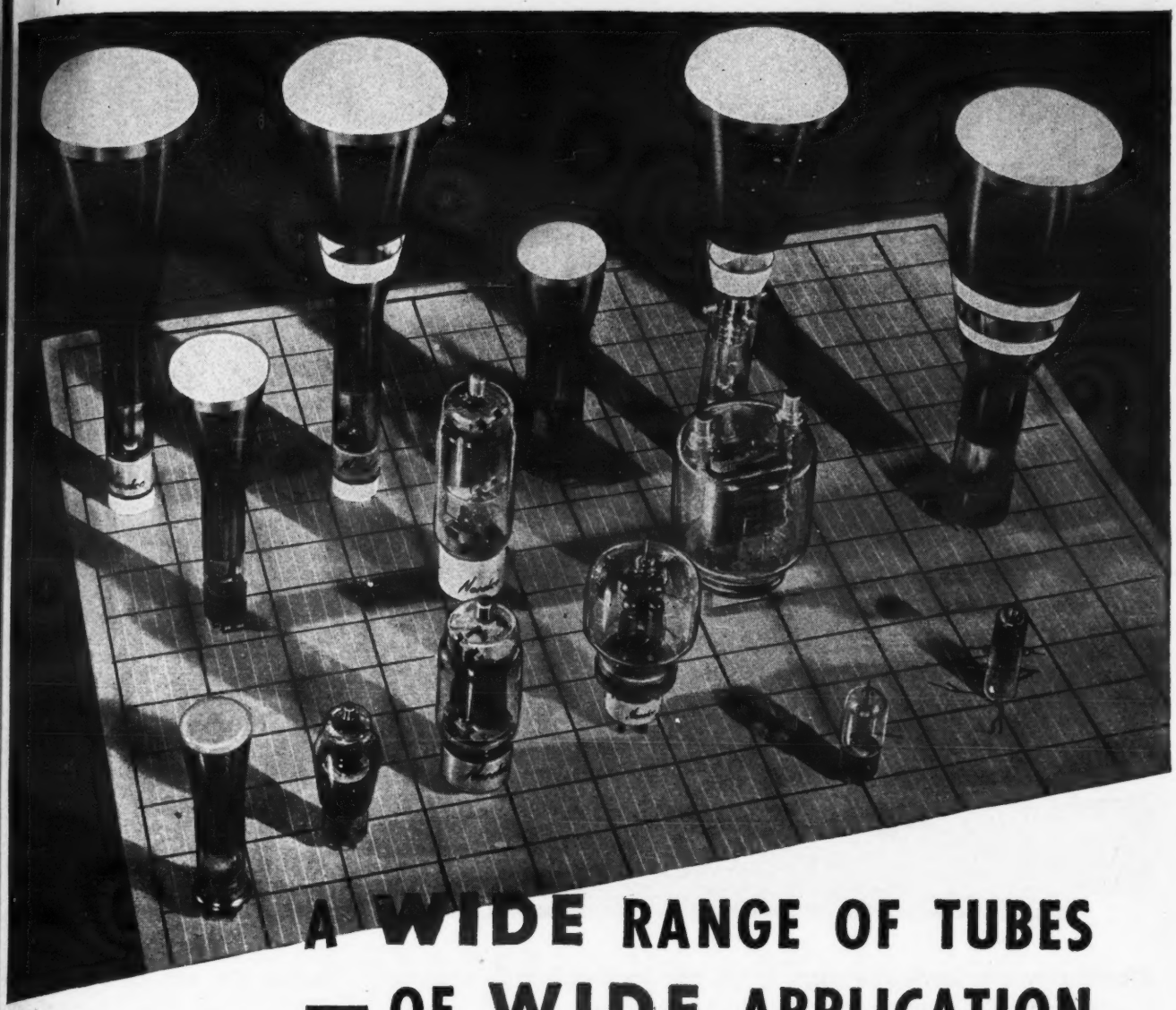
Data—	Softening Point	Dielectric Strength volts/mil.
P903	146° C.	2800—3300
P904	177° C.	2800—3300

P904 can be baked 8 hours at 140° C. in a coil.

Lumarith*

Reg. U. S. Pat. Off.

A CELANESE PLASTIC



A WIDE RANGE OF TUBES —OF WIDE APPLICATION

THE enviable engineering tradition on which the foundation of the North American Philips Company, Inc., rests, is reflected in the superior quality and performance of electronic tubes bearing the NORELCO stamp. Contributing to the long life and uniform characteristics of these tubes are many exclusive manufacturing techniques and inspection methods developed over a long period.

Among the types we now manufacture — some of which are illustrated — are a number of special-purpose, cathode-ray and transmitting tubes for high and ultra-high frequency applications, r-f and a-f power amplifier tubes, and low- and high-power rectifiers. Although all the tubes we produce now go to the armed forces, we invite inquiries from prospective users. A list of the tube types we are especially equipped to produce will be sent on request.

In the North American Philips Company, there is gathered together a team of outstanding electronic engineers, captained by one of America's leading physicists, and coached by a group with world-wide experience resulting from fifty years of research and development in the electrical field. This new combination of technical talent has at its command many exclusive processes that insure electronic devices of the highest precision and quality. Today, North American Philips works for a United Nations Victory; tomorrow, its aim will be to serve industry.

NORELCO PRODUCTS: In addition to the electronic tubes mentioned above we make Quartz Oscillator Plates; Searchray (X-ray) Apparatus, X-ray Diffraction Apparatus; Medical X-ray Equipment, Tubes and Accessories; Electronic Measuring Instruments; Direct Reading Frequency Meters; High Frequency Heating Equipment; Tungsten and Molybdenum products; Fine Wire; Diamond Dies.

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Dept. G-9, 100 East 42nd Street, New York 17, N. Y.

Factories in Dobbs Ferry, N. Y.; Mount Vernon, N. Y. (Metalix Division); Lewiston, Maine (Elmet Division)

Electric power for farms is no longer a mere convenience or luxury; it has become a necessity. It took the war to drive home this point—for the manpower shortage became so acute that farm production was curtailed by lack of help.

One answer to this critical problem was expanded electrification—and Bethlehem was ready with Ruralductor. Years before the war, Bethlehem had been developing this rugged steel conductor for use in farm-electrification programs.

Each of the wires in Ruralductor is coated with zinc—a uniform, ductile covering that protects against corrosion. The zinc coating is 99.9 per cent pure; is applied electrolytically by Bethlehem's exclusive bethanizing process, and is available in A, B, and C weights.

Where Ruralductor Is Practical

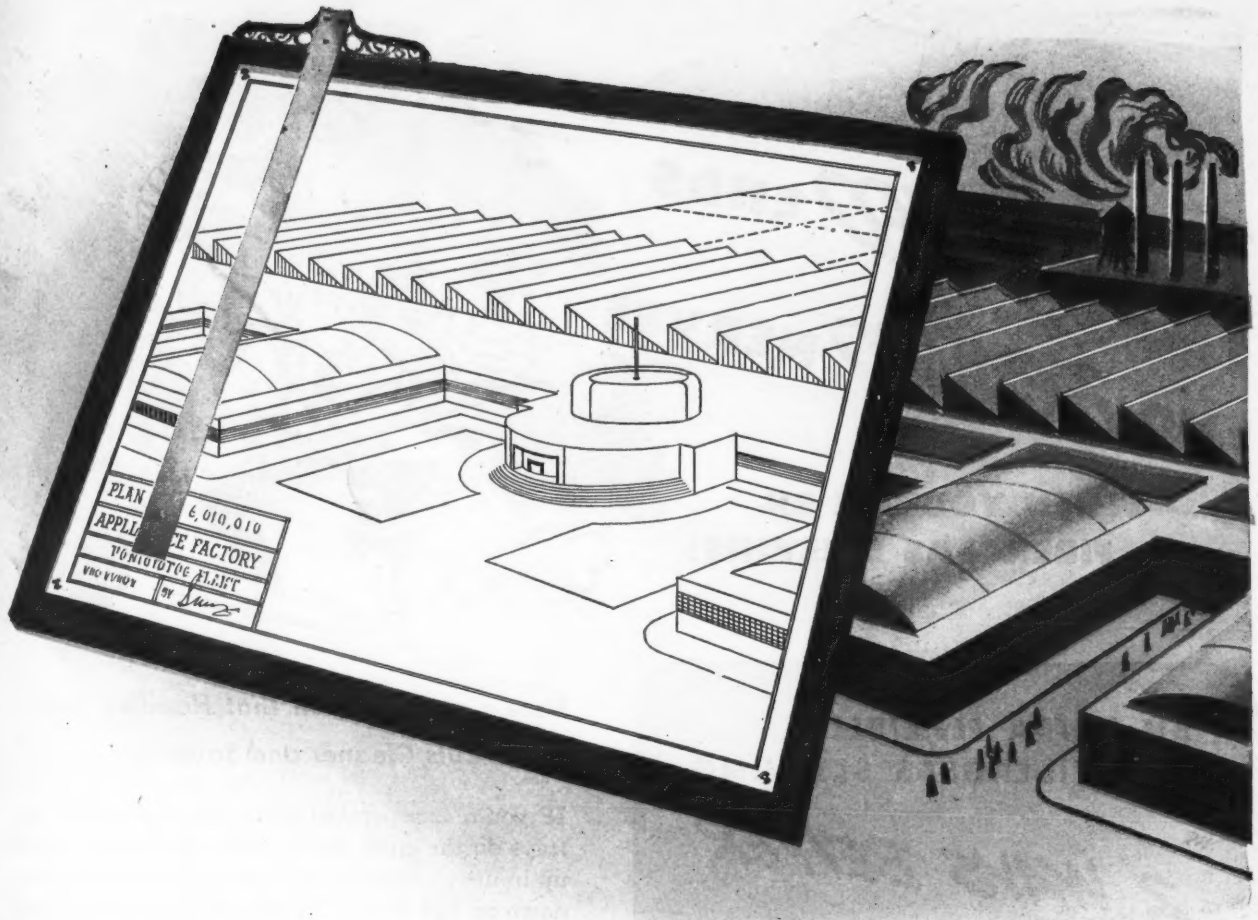
Ruralductor finds its greatest field in layouts where secondary feeders and tap mileage predominate . . . hence it is highly suitable and economical for much of the rural mileage yet to be built. Its electrical capacity, while less than that of the non-ferrous conductors, is adequate for the purpose. Moreover, as Ruralductor is made of steel, it has the strength required for safe use on longer spans — *with consequent reduction in the number of pole structures needed.*

During the war emergency, Ruralductor has been pressed into service in primary feeder lines. Although its performance there has surpassed expectations, it is not generally recommended for this type of use.

Planning for Postwar Expansion

Most utility companies and electrical engineers are already looking ahead to the postwar era. To these planners we offer a suggestion: talk to a Bethlehem representative about the numerous advantages of bethanized Ruralductor. They are advantages that will reduce both installation and maintenance costs that will assure long-range economy

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ BETHLEHEM STEEL ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★



Tomorrow's Air-Conditioned Industry

is on Engineers' Drawing Boards Today

Air Conditioning as a tool to produce hitherto-unheard-of miracles of precision has become well established during wartime. Increased employee efficiency and morale are no-less-desirable collateral advantages.

That's why many an industrial postwar plan includes Modern Air Conditioning as an essential of new and reconverted plants. Yes, air-conditioned industry is a thing of the present—and, increasingly, of the future. And power companies will welcome it as an important load-building factor.

Modern Air Conditioning means Westinghouse—and its years of pioneering research and engineering experience.

For essential war uses in factories, hospitals, airports, military bases, etc., Westinghouse Air Conditioning and Industrial Refrigeration Equipment is available today.

For executives, architects and engineers now planning postwar building and modernizing, dependable data and competent application engineering assistance are ready.

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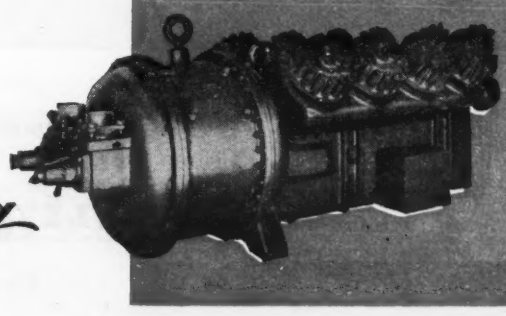
HERMETICALLY-SEALED FOR DEPENDABILITY

Westinghouse pioneered the Hermetically-Sealed Compressor. Hermetically-sealed means light weight • small size • low maintenance and operating costs • high efficiency • long life.



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WHEN YOU USE BH FIBERGLAS SLEEVING!

Here's an Insulation that Handles Easier, Cuts Cleaner and Saves Time

IF you're exasperated by ordinary sleeving that frays on the ends, works stiffly and doesn't hold up in use . . . then you'll certainly want the low-down on BH *Extra Flexible* Fiberglas Sleeving! For this is a really *flexible* and definitely *non-fraying* sleeving—built around the excellent insulating qualities of Fiberglas by an *exclusive* BH process.

Fiberglas, you know, is moisture-resistant, high in dielectric and tensile strength and is shunned by fungus growths and unharmed by most chemicals. "Punishment" tests prove that BH *Extra Flexible* Fiberglas Sleeving has even more advantages. It is *permanently* non-fraying and non-stiffening. It won't burn because both yarns *and* impregnation are non-inflammable. And it lasts indefinitely without cracking or rotting.

Assembly and repair men say BH *Extra Flexible* Fiberglas Sleeving is a pleasure to handle and a sure bet for long life in the most severe service. So why tolerate a less efficient sleeving any longer? BH is available in all standard colors and all sizes from No. 20 to ⅜", inclusive. Write for samples today and make your own comparison!

BH PRODUCTS

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STOP "Leap-Frog" Corrosion

Federal Cathodic Protection Rectifier, Model FTR 5114-S. Output 20 amperes at 10 to 40 volts. Other sizes as required.

"Leap-Frog" Corrosion damages underground pipes and cables.

Pipes or other metal structures are in places electro-positive in relation to the soil and due to natural galvanic action corrosion results. Metal is taken away from one section of pipe and deposited somewhere else along the exposed pipe.

By using Federal Cathodic Protection Rectifiers, "Leap-Frog" corrosion is foiled. On constant guard is a direct current charge which cancels the harmful electrolytic corrosive action on oil, gas and water pipelines and underground cables.

These Federal units have no moving parts, so they last indefinitely — with the absolute minimum of attention. In desert heat or torrid dampness they keep on the job day and night.

Proper engineering for the corrosion problem at hand calls for the specialized consulting engineering service which is yours — when you look to Federal. Write today for full details.

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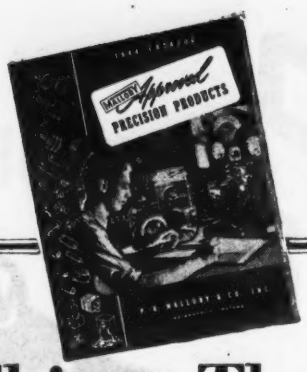

Write today for your free copy of the new Mallory catalog

All Mallory component parts are available from Mallory distributors conveniently located throughout the United States and Canada. Complete listings of these units—their sizes, dimensions and rated capacities—are contained in this Mallory Catalog. Send today for your free copy.

Little Things That Count

The component electronic parts pictured here are not very dramatic. You'll never find newspaper headlines written about them. But they're playing important roles in battle—in Allied equipment all over the world.

That air or naval victory you read about may well have depended upon them. They're vital, fighting parts, required to perform perfectly in communication instruments in planes, tanks, ships and in many types of testing and electronic equipment.

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Before you specify "special" parts that require valuable time in designing and tooling costs, consult Mallory. We have a complete selection of electrical and electronic components in a broad range of types, sizes and capacities—standard parts to save you money. See your Mallory Distributor.

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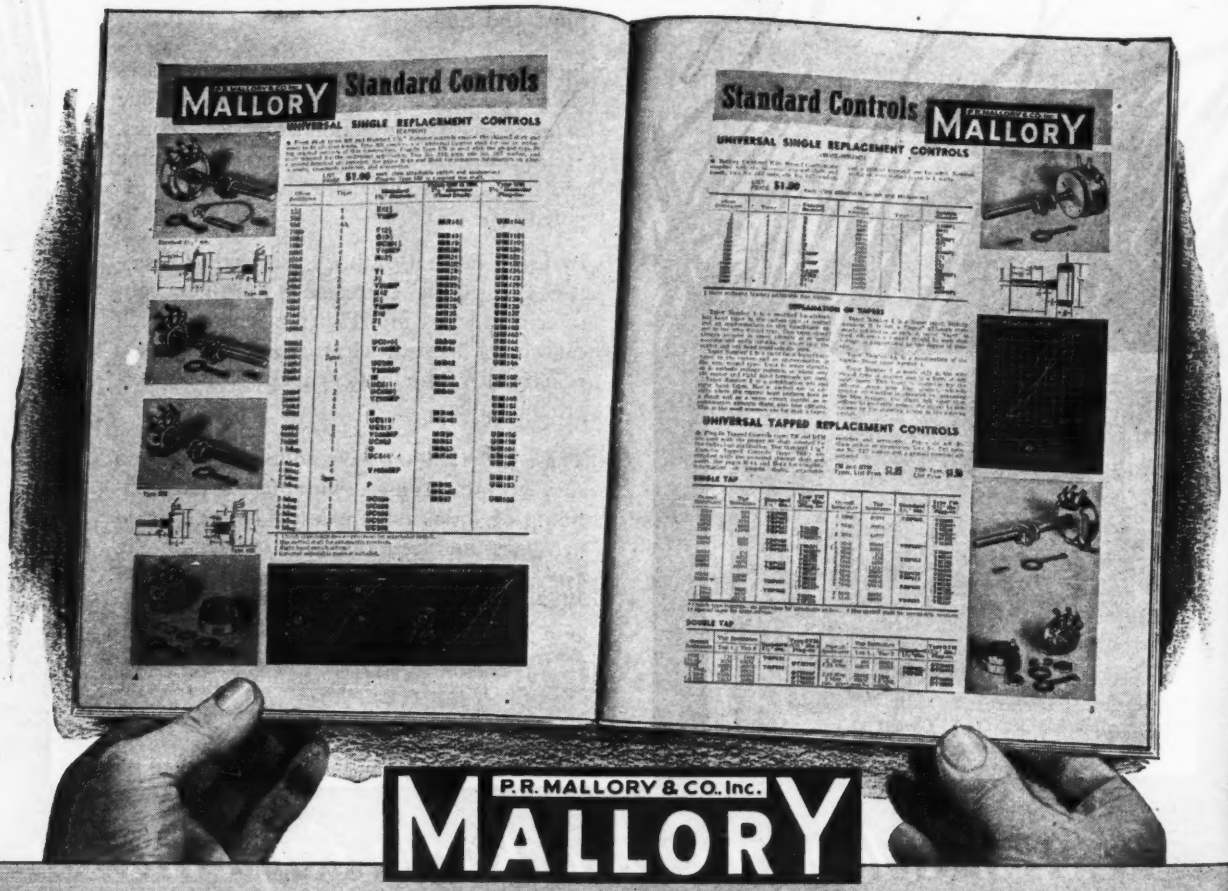

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Approved Precision Products

MOLONEY CSP*

*COMPLETELY SELF-PROTECTED

TRANSFORMERS

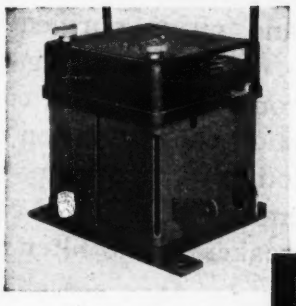
Self-Protected Against Damage Resulting From

1. OVERLOADS
2. SHORT CIRCUITS
3. LIGHTNING

EXCESSIVE overloads and secondary short circuits cannot damage Moloney CSP transformers. A thermally-operated secondary circuit breaker automatically disconnects the load from the transformer before the winding temperature approaches the maximum safe value. Advance warning of overloading is given by a warning light provided in the breaker operating handle.

Protection against damage resulting from lightning is provided by "De-ion" gaps in combination with a tank discharge gap. Service continuity is maintained under the most severe lightning conditions.

In addition to these features, Moloney CSP transformers are provided with the same plus values featured in Moloney conventional Type KL and CL transformers including: 1. Ratio adjuster operating handle above hot oil level; 2. Uniformly high impulse strength; 3. High thermal capacity; 4. Core-and-coil unit anchored above oil level.



Type TR breaker with warning light contacts. Standard on sizes 5 Kva and larger. Type FR breaker without warning light contacts is standard on 1½ and 3 Kva ratings, but Type TR can be supplied if desired.

Breaker reset handle with built-in warning light. Light goes on when load raises temperature of windings to a dangerous level. Should load continue to increase, the breaker trips. Turning reset handle resets both light and breaker.

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In the De Laval Centrifugal Insulating Oil Purifier, water is discharged continuously and oil is purified at a relatively low, non-carbonizing temperature. Automatic oil flow control and thermostatic heat regulation make practically automatic operation possible. (Except for removal of colloidal carbon from circuit breaker oil, no filter media are used.)

De Laval Insulating Oil Purifiers are available in several sizes, both as portable and stationary units. Write for additional details.

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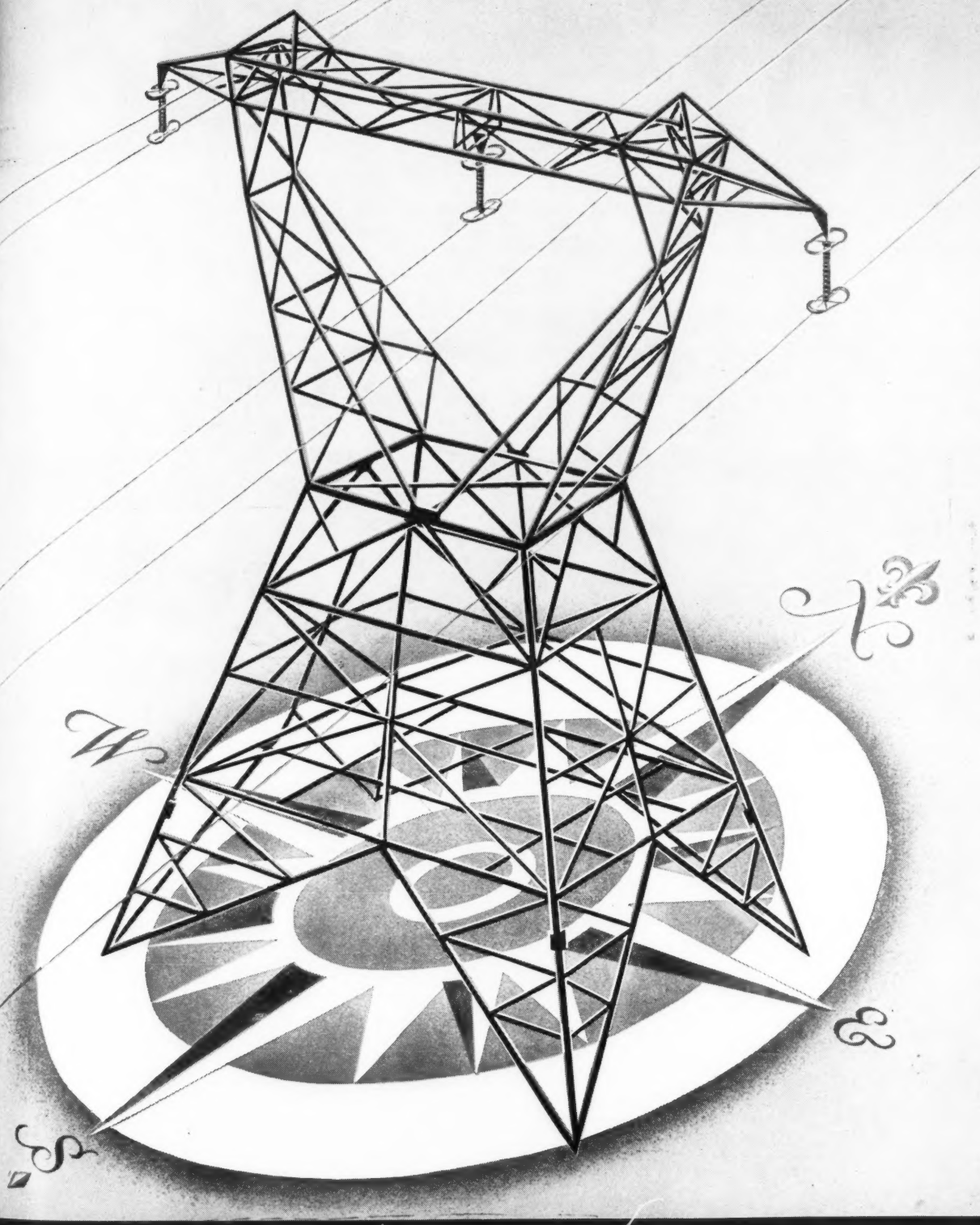
Keeping the power-lanes open has been the utility engineers' invaluable contribution to America's vast military program. Their success is attested by the fact that power failures are now so rare that industry has ceased to anticipate their possibility! North, South, East and West, utility engineers continue to favor Blaw-Knox transmission towers for their advanced design and dependable performance.

BLAW-KNOX DIVISION of Blaw-Knox Company • 2013 Farmers Bank Bldg., Pittsburgh, Pa.



BLAW-KNOX TRANSMISSION TOWERS

National Electric Surface Raceways for surface wiring are easily installed. They have a neat appearance and may be painted with either oil or water paints to match interiors. These raceways are securely fastened to all fittings. No screw connections necessary. Push tongue connection insures perfect permanent ground. Wires are laid in the base; the capping snaps on. No fishing or tearing up walls or floors.

Write for descriptive literature on "La-in" surface raceways.
Listed and approved by Underwriters' Laboratories, Inc.

National Electric Products Corp.
Pittsburgh, Pa.

Electrical World

SEPTEMBER 30, 1944

The Job Belongs to All

ARE GOOD PUBLIC RELATIONS for the private electric utility industry the sum of the public relations of all the components of the industry? Is it sufficient that a company build its own fences, or is it necessary in addition that it unite with others to do an industry job?

These are the questions which were propounded recently by a company which has of late been making a planned effort to recapture the good will of the people in its community and which apparently is meeting with more than a little success. This company frankly wants to know why it should divert any money it has available for building public relations away from its own community to a national fund such as that for the advertising and radio program.

There are probably other companies which feel that by taking care of their own situations they are contributing most to industry welfare. Certainly it must be something of this nature that is responsible, at least to some degree, for the fact that not more than 173 companies are contributing to the industry program.

No one will deny that a company's first responsibility lies in putting its own house in order. National industry publicity is no substitute for sound local public relations.

On the other hand, one cannot assume that he can build a fence around his property and thereby keep out all seeds of discord. If every property were doing its level best to create the most favorable public opinion for itself there undoubtedly would be less need for a joint industry program. But everybody isn't.

When a few companies are negligent the bad feelings that are generated cry out for relief, giving to the opposition more ammunition to battle the just as well as the unjust. It is well known that regulation or remedial legislation seldom comes as the result of malpractices on the part of the many but on the part of the minority—and a very small minority at that.

That is one reason why industry public relations are not the sum of the public relations of its components or ever can be. And a second reason is that while people may believe that their own service company is all right they may still think that there is a power trust and that something ought to be done about it. Good local relations, in other words, do not necessarily create good national relations. Since so many of the attacks on the industry are national, it should be apparent that something more than local effort is needed for industry protection.

During the war, attacks on the industry abated somewhat, but as soon as the war is over they can be expected to be renewed with even more vigor. The need then for a better-informed public will be greater than ever before. The advertising must be supplemented with a full program of information for both the public and the employees. More and more money must be spent to combat the efforts of those who would destroy the private industry.

If the individual members of the industry feel that private initiative should be preserved they must be willing to fight for it not only at home but in other localities, for the loss of it in one place makes it easier for the next place to fall. This isn't a job that can be done, or should be permitted to be done by a few. It belongs to all.

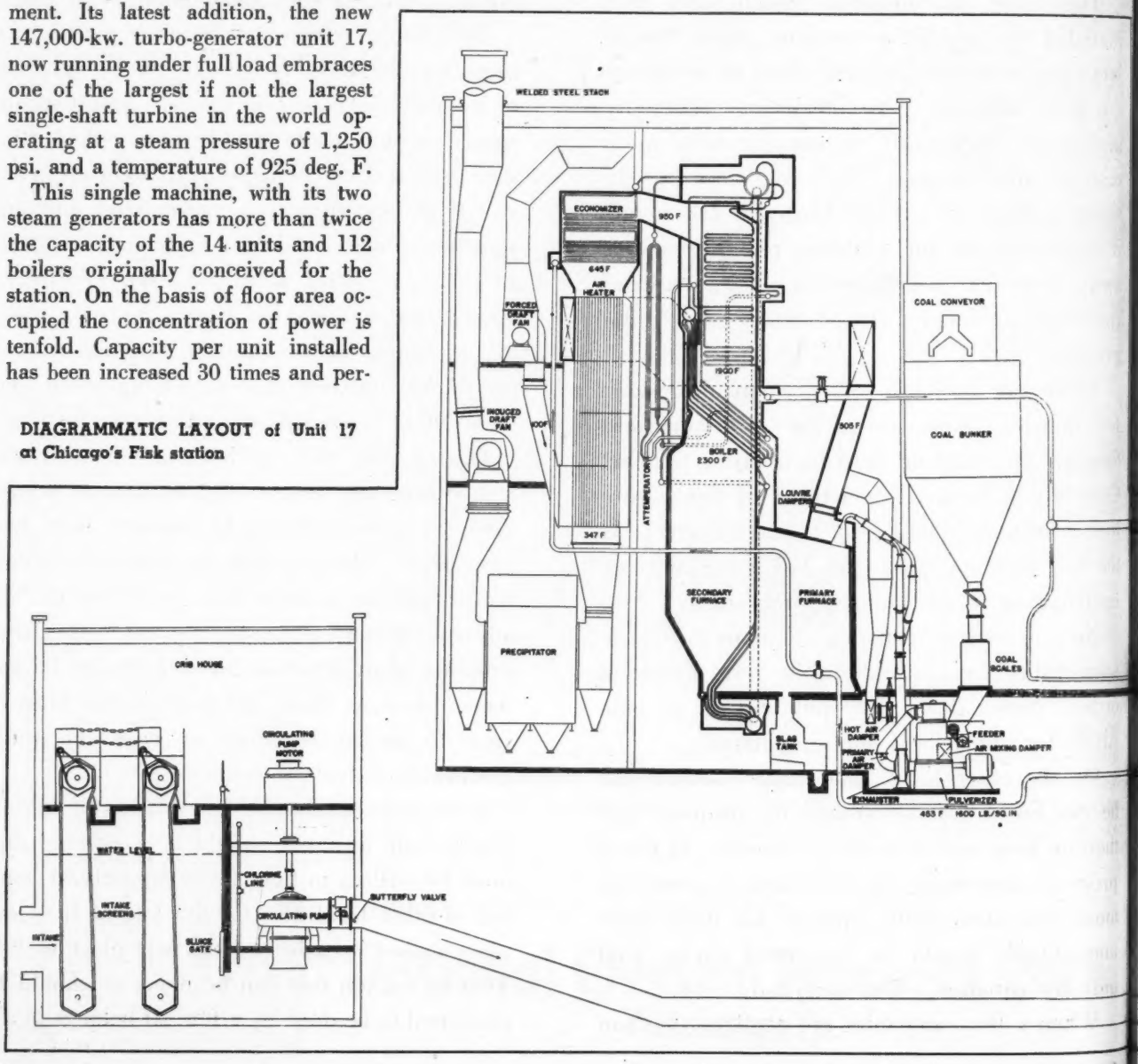
147,000-Kw. Addition Another Milestone at Fisk

America's first all-turbine power station expanded by addition of 147,000-kw. turbo-generator and two 750,000 lb. per hr. 1,325 psi. 935-deg. F. steam generating units. Largest turbo-generator placed in service since Pearl Harbor adds to Chicago's power pool

HISTORIC FISK STATION in Chicago—first all-turbine power plant in America—has passed another milestone in power generation development. Its latest addition, the new 147,000-kw. turbo-generator unit 17, now running under full load embraces one of the largest if not the largest single-shaft turbine in the world operating at a steam pressure of 1,250 psi. and a temperature of 925 deg. F.

This single machine, with its two steam generators has more than twice the capacity of the 14 units and 112 boilers originally conceived for the station. On the basis of floor area occupied the concentration of power is tenfold. Capacity per unit installed has been increased 30 times and performance has been improved 500 percent.

Turbine heat rate of the new unit at full load is 8,750 B.t.u. per kw.-hr. gross. Auxiliary power at full load amounts to 7,000 kw. so that with



DIAGRAMMATIC LAYOUT of Unit 17 at Chicago's Fisk station

boiler room efficiency of 87 percent the overall net heat rate will be about 11,000 B.t.u. per net kw.-hr.

Commonwealth Edison selected Fisk Station for this latest addition to the Chicago area power pool because of the station's proximity to the center of the load and the economics made possible there through the replacement of three outmoded, inefficient machines. Adoption of 147,000 kw. as the unit size was dictated by two factors, the space economy of its compact design and the estimated additional capacity requirements of the system as a whole. The operating steam pressure and temperature were chosen principally because of their desirability for an economical, modern straight-through simple condensing turbine.

Historic sequence of units installed at Fisk since it was placed in service in 1903 is given in Table I.

How Space Was Provided

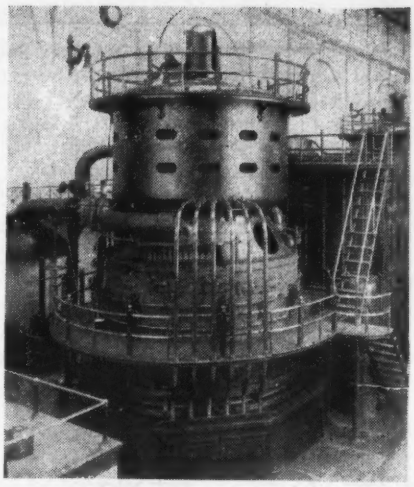
Space for the new machine was provided by removing vertical units 8, 9 and 10. Room for the two steam generators and four feed pumps was afforded by removing the boilers originally installed for units 6, 7 and 8. Thus 147,000 kw. was installed in a station area originally provided in 1903 for 15,000 kw. Moreover, it replaced obsolete units representing installed capacity of 36,000 kw.

A diagrammatic layout of the unit 17 installation is shown. Allis-Chalmers constructed the turbo-generator and Babcock & Wilcox the boilers.

Boiler Features

Two steam generating units, each designed to provide 750,000 pounds of 1,325 psi., 935 deg. F. steam per hour are provided. They are B. & W. high-head type, equipped with continuous-tube drainable superheaters, continuous-tube economizers, tubular air heaters, inter-tube type attemperators, water-cooled furnace walls and continuous slag-tap furnaces. Relatively low furnace heat release and wide tube spacing in the generator convection banks and superheaters were stipulated to prevent slag fouling. As a result effective slag removal is attained with the mechanical blower installations composed entirely of retractable blowers in the boilers, superheater and economizer sections. The heat absorbing surfaces are arranged to facilitate effective mechanical cleaning.

Particular attention was paid to obtaining adequate and effective boiler water circulation. The 25-in. down-comers from each end of the steam drum to the bottom drum provide adequate solid water supply. Provisions for single-circuit, positive circulation have proved adequate since no tube failures have occurred to date. The steam generators had been in service nearly a year before the turbine, furnishing steam to similar pressure equipment in the station and through a pressure-reducing and desuperheating system to low-pressure equipment. This preliminary operation demonstrated that the boilers would require very little adjustment

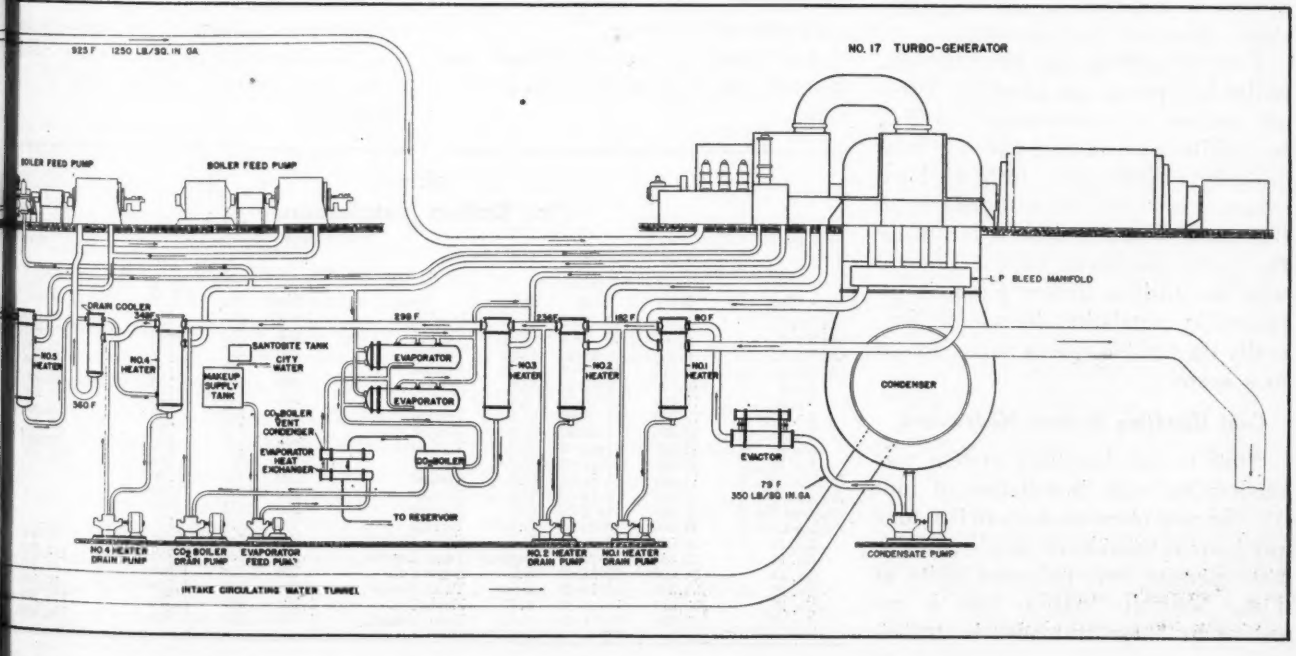


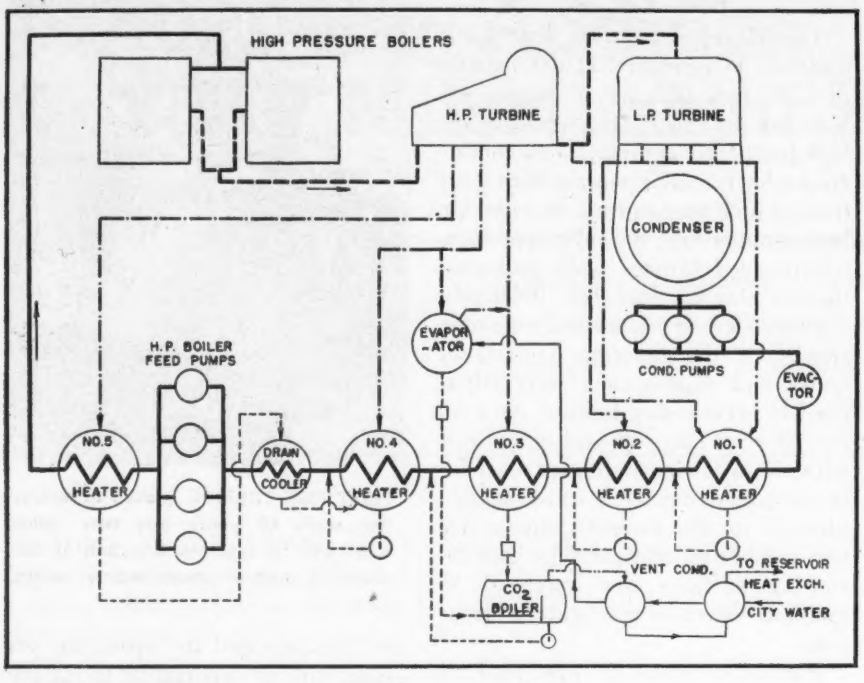
FIRST FISK TURBINE, placed in operation some 40 years ago was rated 5,000 kw. It was the first unit of the country's premier steam-turbine power plant

and has provided the operating personnel with an opportunity to put into practice the training received in an instruction program completed before the equipment was ready for service.

Automatic Boiler Control

Three methods of control—full automatic, boiler manual and hand—are provided by the automatic boiler control system. On full automatic control the system is actuated by changes in main steam header pressure through a master pressure element controlling the regulators of both boilers. With boiler manual control the regulators of either boiler may be controlled by a single control element. Under hand control the regulators of





STEAM FLOW diagram for new installation at Fisk station

each boiler may be controlled individually from the boiler board.

Control of steam passing through and by-passing the attemperator of each boiler is controlled only by a remote hand control unit to regulate final steam temperature.

Efforts to attain simplicity in the control system have resulted in a reliable system, although the installation is complicated by the fact that two induced-draft fans, two forced-draft fans and three sets of mills and feeders per boiler may be operated in various combinations. The control system is arranged to accommodate these operating requirements.

Four 600,000-lb. per hr. 1,600-psi. boiler-feed pumps are provided. Three are driven by constant-speed 1,750-hp. 3,570-r.p.m. motors and one by a 1,540-hp. 3,340-r.p.m. turbine. Feed pressure is controlled manually from the motor driven pumps by throttling the pump discharge valves. Control with the turbine driven pump is attained by regulating its speed. Normally the turbine driven pump is used as a spare.

Coal Handling System Modernized

Station coal handling system was modernized with installation of unit 17. The new plant capacity of 800 tons per hour is considered ample to serve both present and proposed units at Fisk. Normally station coal is received by barge, unloaded by traveling tower crane, crushed to 1¼ in. minus size by two 500-ton per hour breakers and transferred to the boiler bunkers by belt conveyors. Alternate coal supply may be received by rail. Cars are unloaded by a rotary car dumper, designed to empty 20 cars per hour.

Coal for the new unit is transferred to 1,000-ton bunkers, one for each boiler. Thence it flows to three 17.5 ton per hr. bowl mills. After pulverization to 70 percent through 200-mesh screen it is fed to the furnaces by 12 multi-tip, intertube, pulverized coal burners disposed across the top of each primary furnace.

Fuel fired is Central Illinois coal with an ash content of about 14 percent.

Ash and Slag Disposal

Electric precipitators, one for each boiler unit, are located in the gas duct between the air heaters and induced draft fans. Fly ash collected in the precipitator hoppers is removed periodically by a hydrovac dust system. Dust from the 16 hoppers under each precipitator is removed automatically, transported to a vacuum dust collector bin and fed continuously to a 500-ton dust storage bin by a vacuum sealing dust feeder. Dust from the overhead storage bin is passed through a mixer and unloaded (where water is added to produce a commercially dustless mixture) to rail cars.

Furnace slag—melted ash—flows automatically from the furnace walls through two water-cooled slag holes in each primary furnace floor to two water filled slag tanks for each boiler. It is periodically sluiced from these tanks to an outside ash pit for disposal.

Curtis-reaction Turbine

The turbine is a 1,250 psi., 925 deg. F., 1,800 r.p.m. Allis-Chalmers tandem compound, Curtis reaction condensing unit. The steam path consists of a Curtis stage and 39 reaction stages. Blades in the last row of the double-flow low-pressure turbine have a top speed of 1,135 ft. per sec. The throttle steam flow is 1,262,000 lb. per hr. at full load, while the condenser flow is 845,300 lb. per hr. The difference of 416,700 lb. per hr. is bled for feed water heating. Five bleed points are provided. Three are located in the high-pressure turbine, one at the cross-over connection and one in the low pressure turbine. Final feed water temperature of 455 deg. F. is attained.

Table I
Fisk Station Installations

Unit	Capacity KW	Service Date	Make	Type	Throttle Steam Conditions: Press. Lb. (Gage)	Throttle Steam Conditions: Temp. F.	Speed R.P.M.	Boilers: No. Per Unit	Boilers: Cap. Each
Old No. 1	5,000	10- 2-03	G.E.	Vertical	200	513	750	8	25,000
Old No. 2	5,000	12-11-03	G.E.	Vertical	200	513	750	8	25,000
Old No. 3	5,000	4-21-04	G.E.	Vertical	200	513	750	8	25,000
Old No. 4	7,500	10-27-04	G.E.	Vertical	200	513	750	8	25,000
No. 5	12,000	9-17-06	G.E.	Vertical	200	513	750	8	25,000
No. 6	12,000	10-10-06	G.E.	Vertical	200	513	750	8	25,000
No. 7	12,000	11-13-06	G.E.	Vertical	200	513	750	8	25,000
No. 8	12,000	1-22-07	G.E.	Vertical	200	513	750	8	25,000
No. 9	12,000	7-19-07	G.E.	Vertical	200	513	750	8	25,000
No. 10	12,000	9-17-07	G.E.	Vertical	200	513	750	8	25,000
Replaced No. 4	12,000	5-21-09	G.E.	Vertical	200	513	750	..	.....
Replaced No. 3	12,000	6-14-09	G.E.	Vertical	200	513	750	..	.....
Replaced No. 2	12,000	9- 3-09	G.E.	Vertical	200	513	750	..	.....
Replaced No. 1	12,000	10-28-09	G.E.	Vertical	200	513	750	..	.....
No. 14	20,000	3-30-14	G.E.	Single Cyl.	220	588	1,200	4	90,000
No. 11	25,000	6-21-14	Parsons	Tand. Compd.	220	588	750	4	80,000
No. 13	30,000	12-24-19	G.E.	Single Cyl.	220	588	1,800	4	90,000
No. 12	35,000	1-18-20	West.	Tand. Compd.	220	588	1,500	4	80,000
No. 15	30,000	10- 8-37	A. C.	Single Cyl.	1,200	900	1,500	2	375,000
No. 17	147,000	12-11-43	A. C.	Tand. Compd.	1,250	925	1,800	2	750,000

Because of the large amount of steam required, the turbine is provided with two steam chests, one on either side of the high pressure cylinder. On each steam chest is mounted a 14-in. throttle valve and three 12-in. admission valves. An equalizing line connects the two steam chests to equalize flow at high loads. The turbine is designed for four valve points, two to the impulse stage, the third ahead of the reaction blading and the fourth by-passing six reaction stages.

Spindle Forging

The blade-carrying portion of the high-pressure spindle is machined from a solid single forging. A stub end is shrunk, keyed and bolted at the low-pressure end. The low-pressure spindle consists of a built-up, welded assembly of forged-steel discs and two forged-steel shaft ends. This construction, unique in design, is used to insure a sound structure in the size of spindle involved.

The 90,000-sq. ft. welded steel shell, radial-flow, single-water-pass condenser is equipped with arsenical admiralty tubes. Circulating water pumps are two 54-in. motor-driven, vertical-shaft propeller units each with a capacity of 82,500 g.p.m. Both are located away from the unit in the station screen house. Three five-stage, motor driven, 1,050 g.p.m., condensate pumps deliver condensate at approximately 350 psi. pressure through the feedwater heating system to the suction of the boiler feed pumps.

Heat Flow

Flow diagram of the unit is shown. Condensate is pumped from the deaerating storage hotwell at the bottom of the condenser through the feedwater heating system to the boilers. The feedwater heating system consists of five vertical feedwater heaters, a drain cooler, a CO_2 boiler, a vent condenser and a heat exchanger. Condensate from the condenser hotwell is discharged at 350 psi. from the hotwell pumps through No. 1, 2, 3 and 4 heaters and drain cooler to the suction header of the boiler feed pumps. These pumps discharge at 1,600 psi. through the No. 5 or high pressure heater to high pressure feed header.

Heaters No. 1, 2 and 4 have drain pumps which discharge to the main feedwater line on the discharge side of the heater served. The drain from No. 3, which functions both as an extraction heater and evaporator condenser passes through a drainer to the CO_2 boiler. A drain pump discharges the flow from the CO_2 boiler to the main feedwater line on the outlet side of No. 3 heater. The drain from the high-pressure heater passes through the coils of the drain cooler and then to the steam space of No. 4 heater.

Dissolved Gases Liberated

Condensed steam from the evaporator coils passes through a drainer into the CO_2 boiler where it mixes with the drainage (evaporator distillate) of No. 3 heater. The condensed steam from the evaporator coils, being at a higher temperature than the drainage from the No. 3 heater, causes flashing in the CO_2 boiler, liberating dissolved gases from the make-up before it enters the feedwater stream. The vapor and gases driven off in the CO_2 boiler pass to the vent condenser where the vapor is condensed by the raw water going to the evaporator and the free gases are vented to the atmosphere. The condensed vapor from the CO_2 boiler vent condenser passes to the heat exchanger, giving up heat to the raw water passing through the tubes, and is finally discharged to the reservoir. The amount of raw water evaporated constitutes the required make-up of the cycle.

Generator

The generator is a 147,000 kw. 60-cycle, 12,600 volt, three-phase air cooled unit. It is designed for 85 percent power factor operation. Because of the machine's large capacity both in kilowatts and amperes, its armature has two electrically independent windings, each of which connects to a separate bus system. The terminals of the two windings are brought out on opposite ends of the armature to relieve congestion of cables under the machines as much as possible.

Because of the large size of the field, its core is built up of a forged steel shaft provided with axial, serrated grooves into which teeth are fitted to form the sides of the coil slots and the center of the poles. This construction avoids the extremely large forging that would be required if one-piece construction were used as on smaller machines.

List of Equipment

High-Pressure Turbo-Generator:
Mfr.—Allis-Chalmers Mfg. Co.
1—147,000 kw. 1,800 r.p.m. turbine
1,250 psi., 925 F throttle
1 in. Hg. exhaust pressure
2—impulse rows—39 reaction stages
1—147,000 kw. double winding generator
12,600 volt, 3-phase, 60 cycle, 80% P.F.

Condensing Equipment
Condenser
Mfr.—Westinghouse Electric & Mfg. Co.
One-pass radial flow surface type
Tube surface—90,000 sq. ft.
Condensate Pumps
Mfr.—Westinghouse Electric & Mfg. Co.
3—1050 g.p.m., 350 psi., 4 stage
Steam Jet Air Pumps
Mfr.—Westinghouse Electric & Mfg. Co.
2—2 element, 2 stage air evactors
Circulating Water Pumps
Mfr.—Worthington Pump & Machinery Corp.
Number of pumps—2
Capacity—82,500 g.p.m.

High Pressure Boilers
Mfr.—Babcock & Wilcox Co.
2—750,000 lb./hr., 1,325 psi., 935 F.
Steam generators
Effective Heating Surfaces
Boiler, sq. ft., 4954
Furnace to Suph't'r., sq. ft. 11,300
Boiler and Waterwall
Above Suph't'r. Entrance, sq. ft. 15,304
Superheater, sq. ft. 39,480
Economizer, sq. ft. 26,323
Air Heater, sq. ft. 100,218
Attemperator, sq. ft. 2,964
Furnace Volume, sq. ft. 116,000
Max. Heat Release—19,400 B.t.u./cu. ft./hr.

Pulverized Fuel Equipment
Mfr.—Combustion Engineering Co.
6—17.5 ton/hr. Raymond Bowl Mills

Fans
Mfr.—B. F. Sturtevant Co.
4—167,000 c.f.m. turbovane induced draft fans
4—Dual speed motors
High speed—700 h.p., 900 r.p.m., 2,000 v.
Low speed—450 h.p., 720 r.p.m., 2,300 v.
4—96,000 c.f.m. turbovane forced draft fans
4—Dual speed motors
High speed—400 h.p., 1200 r.p.m., 2,300 v.
Low speed—225 h.p., 900 r.p.m., 2,300 v.

Electrical Precipitators
Mfr.—Research Corp.
2—75 kv., 54 gas duct Cottrell precipitators
10—25 kva., 440 v., 75 kv. transformers
10—Mechanical rectifiers

Boiler Feed Pumps
Mfr.—Worthington Pump & Machinery Corp.
4—600,000 lb./hr., 1,600 psi., 350 F pumps
3—1,750 h.p., 3,570 r.p.m. Westinghouse Constant Speed Motors
1—1,540 h.p., 3,340 r.p.m. Westinghouse Turbine

Feedwater Heating and Evaporating Equipment
Mfr.—Griscolm Russell Company
1—4,280 sq. ft. 4 pass heater (No. 1)
1—3,800 sq. ft. 4 pass heater (No. 2)
1—3,755 sq. ft. 4 pass heater (No. 3)
1—4,420 sq. ft. 4 pass heater (No. 4)
1—5,020 sq. ft. 2 pass heater (No. 5)
1—1,170 sq. ft. 1 pass drain cooler
1—107,260 lb./hr. CO_2 boiler
1—85.7 sq. ft. 4 pass CO_2 boiler vent condenser
1—206 sq. ft. 1 pass evaporator heat exchanger

Pumps
Mfr.—Ingersoll-Rand Co.
2—100,000 lb./hr., 360 psi., No. 1 heater drain pump
2— 80,000 lb./hr., 370 psi., No. 2 heater drain pump
2—125,000 lb./hr., 350 psi., CO_2 boiler drain pump
2—235,000 lb./hr., 385 psi., No. 4 heater drain pump
2— 60,000 lb./hr., 100 psi., Evaporator feed pump

69-Kv. Line Without Crossarms—Costs Cut

Crossarmless 69-kv. line costs 26 percent less than standard suspension construction—Has equal or better lightning performance—Specifications compared with standard arrangement

USE OF TRANSMISSION structures without crossarms for voltages above 33-kv. has been made by the Central Illinois Public Service Co. on an 11-mile, 69 kv. line from Hutsonville to Robinson, Illinois, built in the spring of 1942 and pictured in accompanying illustrations.

Experience with this line, which uses line post insulators mounted horizontally on the pole with 5 ft. 4 in. spacing, indicates that the unconventional poletop configuration used yields lower construction costs per mile, gives equal or better lightning performance and permits use of narrower rights-of-way than conventional single-pole arrangements.

Two instances have previously been reported* where this type of construction has been used on lines of 1½ and 4 miles in length operating at voltages of 33 and 26 kv. respectively. In both instances, restrictions in conductor clearance or right-of-way width were dominating considerations. In the present instance these factors did not apply since the line paralleled county roads for 60 percent of its length and tree clearance was not a problem. Low cost and trouble-free performance were objectives sought.

Comparison of the costs and specifications of this latest 69-kv., single-circuit line with a 68 mile sample of the company's standard single-pole, double-arm, 69-kv. suspension construction shows a saving of $1,550 per mile or about 26 percent. This saving was realized despite erection costs (mainly labor and haulage) which were $80 per mile more than the comparable standard line due to the higher labor rates prevailing in 1942.

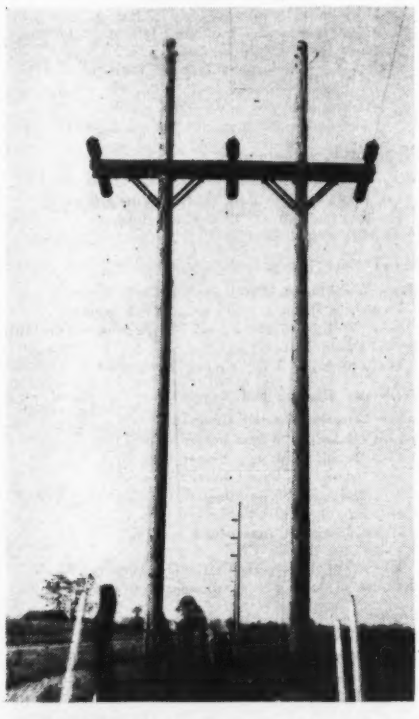
Impulse insulation strength for the new type line is 495 kv. compared with 525 kv. for the crossarm construction. During the first 10 months operation of the bare-bones line, beginning July 31 and ending June 1, 1943, it weathered 18 lightning storms without a single tripout.

Features of Construction

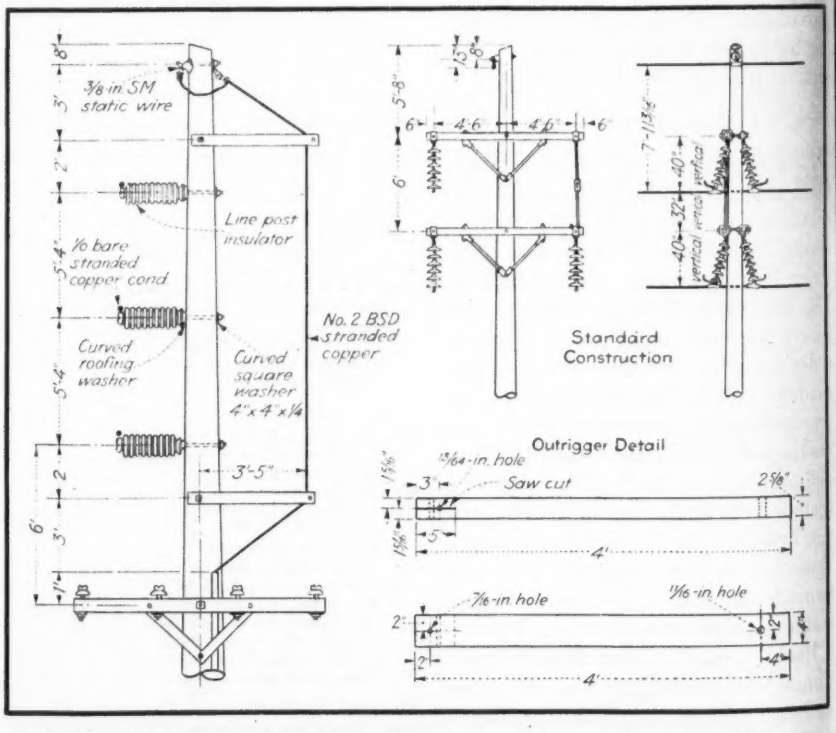
Accompanying drawings show details of the side wire design. Insulator stresses for the horizontal Lapp line post insulators (No. 9982X) are considered to be well within the allowable strength limits.

Phase conductors used are No. 1/0 bare hard drawn copper with a 300 ft. ruling span. Published breaking strength of the 88-kv. insulator used is given by the manufacturer as 2,800 lb. Insulators are attached to the pole with a through-bolt having a 4 x 4 x

* See ELECTRICAL WORLD, May 30, 1942, page 90; also October 2, 1943, page 106.



ONE STRAIN structure per mile in both new and standard construction



COMPARISON of tangent structures of new crossarmless and standard 69-kv. construction. Inset shows detail of ground lead outrigger

4-inch curved square washer on the back of the pole. A round curved roofing washer supplied by the manufacturer is used between the insulator base and the pole. Area of these washers is considered sufficient to hold load on the wood fibers below the crushing strength of wood fibers.

A ⅜-inch S.M. grounded overhead shield wire is fastened to the pole top 5 ft. 8 in. above the top conductor. The No. 2 stranded copper down-lead ground wire at alternate poles is held under tension and away from the pole by two 4-ft. outrigger arms that form a bow-string truss on the side of the pole away from the conductors. This arrangement takes full advantage of the impulse strength of the wood pole.

The method of clamping the ground wire in the outrigger arm is unique. A vertical cut 5 in. long is made along the center line of the arm which was previously drilled with a 19/64 in. diameter hole 3 in. from the end to take the ground wire. A through-bolt clamps the split ends of the outrigger around the ground wire to hold its tension. The outriggers are located 2 ft. above and 2 ft. below the top and bottom conductors as shown.

In comparing this new vertical construction with the company standard 69-kv. construction it should be noted that dead-end for the two types of construction are the same. Dead-end construction is illustrated. One H-frame dead-end structure is used per mile in both lines for anchoring purposes.

The circuit take off and the method of guying on the new type of construction is identical with the standard. They differ only in that the insulators are horizontally mounted on the pole instead of vertically mounted on the arm.

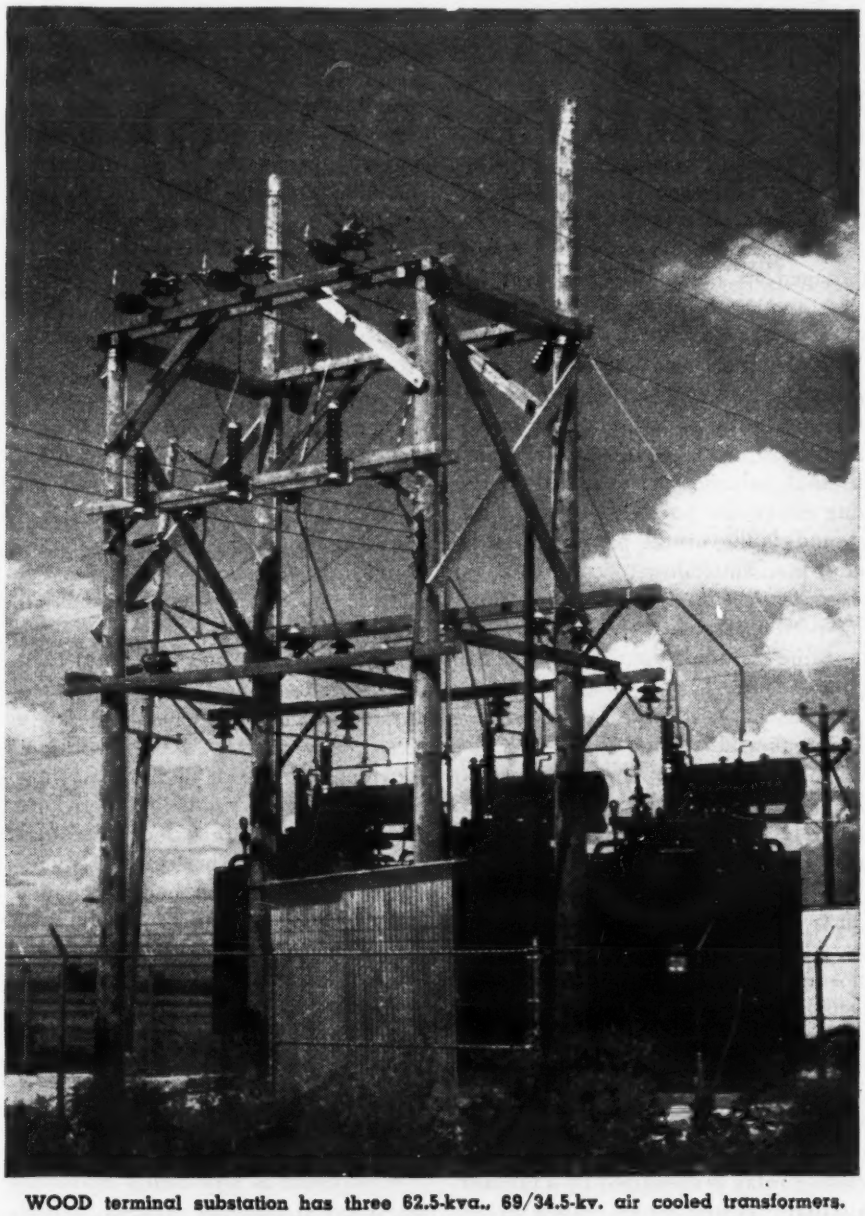
Illustrations, clearly indicate structure details of tangent construction.

Comparative Specifications

	Standard Line	New Line
Voltage, kv	69	69
Length of line, miles	68	11.1
Conductor, Bare H.D. copper	1/0	1/0
Ruling span, feet	300	300
Poles size range, ft.	50–75	50–75
Poles, class, type	No. 1, WRC	No. 3, WRC
O.H. ground wire	3/8 in. S.M.	3/8 in. S.M.
Insulators (tangent structure)	6, 6-unit susp. strings	3–88 kv. line post
Impulse strength, structure, kv.	525	495
Crossarms (4 3/4 × 5 3/4 × 10 ft.)	4	none
Dead end strain structures* (per mile)	1	1
Portion of line along highway—%	60	60

* Note—Dead end and corner structures identical for both types of line.

TANGENT structure with underbuilt rural circuit



WOOD terminal substation has three 62.5-kva., 69/34.5-kv. air cooled transformers. Shield wires are carried into substation

Single-Pole Reclosure Holds Stability and Stresses

Reduced difference angle (and therefore stresses on machine shafts) with relay control that opens only faulted phases and permits prompt reclosure on all except three-phase faults —Appropriate applications indicated

W. A. DERR, Switchgear Engineer, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

FIRST INSTALLATION of single-pole reclosing to a high voltage transmission line was placed in permanent operation in March, 1941, on a 50-mile section of 138-kv. line. On this first installation, it was deemed advisable to reclose only on single-line-to-ground faults, the equipment being arranged to have all three breaker poles trip with no reclosing on all other types of faults.

On the first installation of single-pole reclosing, solenoid-operated breakers with a nominal reclosing time of 30 cycles were installed. The original scheme provided for tripping either one pole on single-line-to-ground faults or all poles on faults other than single-line-to-ground. This, of course, meant that no synchronizing power passed over the transmission line on other than single-line-to-ground faults.

Since the first installation, all of the breakers to which single-pole reclosing has been applied have been pneumatically operated. A somewhat faster reclosing time results from the use of these breakers which is a proper step to reduce system shock. On high-speed solenoid-operated breakers, reclosing is initiated by the closing of the protective relay contacts. That is, the closing relay of the circuit breaker is energized simultaneously with the trip coil. On pneumatically operated breakers, the closing relay is not energized simultaneously with the trip coil. Instead, the closing relay is energized by a breaker auxiliary switch which closes about 5 cycles after the trip coil is energized. On the solenoid-operated breakers an arrangement was used to open the circuit momentarily through the recloser while the protective relay contacts were closed. On the pneumatically operated breakers it was necessary to open the recloser when reclosing was not desired. Fig. 1 shows the arrangement used on the recloser of a single pole of a pneumatically operated breaker.

Discriminating Reclosure

On some recent applications of single-pole reclosing it was deemed advisable to have reclosing take place even though all three poles are tripped on all faults other than single-line-to-ground. In these instances it was felt that the power flow would be of small enough magnitude for a large enough percentage of the time, that other than single-line-to-ground faults occurred to make it advisable to have all three poles reclose. Relay MC, the contacts of which are shown in Fig. 1, is not energized on single-line-to-ground faults, but is energized on all other faults. Thus, it will be seen that a very simple change can be made to change from reclosing on all types of faults to reclosing only on single-line-to-ground faults and vice versa. If the MC contacts are not connected to operate the recloser, reclosing will take place on all types of faults. If the MC contacts are connected to operate the recloser, reclosing will take place only on single-line-to-ground faults.

Equipment is now being manufactured for single-pole reclosing which goes a step farther than any previously furnished. This equipment is arranged to reclose on all types of faults except three-phase faults with only the faulted phases being tripped. Thus, the equipment is arranged so that phases A and B, are tripped on a double-line-to-ground fault on phases A and B. The protective relaying is arranged to energize the trip coils of faulted phases only. On three-phase faults a relay is energized which operates the reclosers and prevents reclosing.

Justification for the added refinement mentioned in the preceding

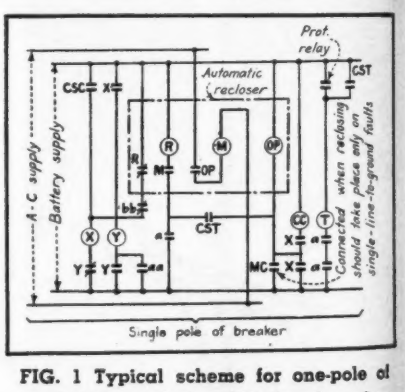


FIG. 1 Typical scheme for one-pole of single-pole reclosing CC, breaker closing coil; CSC, breaker close control switch; CST, breaker trip control switch; MC, relay operated on all faults other than single-line-to-ground; M, motor of automatic recloser; OP, operate coil of automatic recloser; R, reset coil of automatic recloser; T, breaker trip coil; X, breaker closing relay; Y, breaker cut-off relay; A, breaker auxiliary switch closed when breaker is closed; AA, breaker cut-off switch closed when breaker mechanism is closed; BB, breaker auxiliary switch closed when breaker is open

paragraph can be explained with reference to Fig. 2. This figure gives a comparison of the phase angle swings on a typical system for 3-pole reclosing versus reclosing on the basis of only the faulted phase or phases being tripped.

The swing for three-pole operation is shown on curve A of Fig. 2. This is the swing which would result on any type of fault with a gang-operated breaker, but only on a three-phase fault with single-pole operated breakers arranged to have only the faulted phases open. The difference angle between the two systems is a measure of the ability of the systems to remain in step when reclosing is effected and is also a measure of the momentary loadings which will be developed on the shafts of the machines involved.

Curve B of Fig. 2 shows the difference angle between the two systems which results when only the faulted phases are tripped on a double line-to-ground fault, as well as the difference angle resulting from all three poles being tripped on the same type of fault. From this curve it will be seen that the swing of the two power systems is considerably reduced even with only one breaker pole remaining closed, when the transformers at each end of the tie line are grounded. Up to a maximum of 33 percent, power will flow over the single intact phase, the actual amount being dependent on the character of the ground circuit.

Dig into your cellars and attics. Canvass your neighbors. Bundle up all the waste paper you can find and send it off to war.

Curve C of Fig. 2 shows the difference angle between the two systems which results when only the faulted phase is tripped on a single-line-to-ground fault, as well as the difference angle resulting from all three poles being tripped on the same type of fault. The curve shows that the swing of the two systems is very much decreased by having only the faulted phase opened. This is, of course, due to the fact that up to a maximum of 67 percent power can still be transmitted over the unfaulted phases.

Appropriate Application

Since the swing which takes place between two power systems on a reclosing operation is a measure of the shaft loading in the machines, it is obvious from the curves of Fig. 2 that the stresses in the machines can be reduced by opening only the faulted phases on a reclosing operation.

Single-pole reclosing is well adapted to fit into the present-day picture of conservation of existing facilities without impairment to service. A study of phase-angle swings during reclosing operations on a given power system will indicate the type of reclosing required to stay within the stability limit and will also indicate the stresses to which the shafts of the machines will be subjected on various types of faults and with various types of reclosing.

The flexibility of single-pole reclosing equipment makes it possible to have only the proper phases tripped and reclosed on types of faults which are within the stability limit and which will not cause undue stresses in the machines.

Thus, in the instance cited, reclosing takes place on all types of faults except three-phase faults. To prevent excessive stresses in the particular machines involved, no reclosing is allowed on three-phase faults. On this application it would be undesirable to have gang-operated reclosing on any type of fault. The infrequency of three-phase faults means that the tie line will be lost only on very rare occasions.

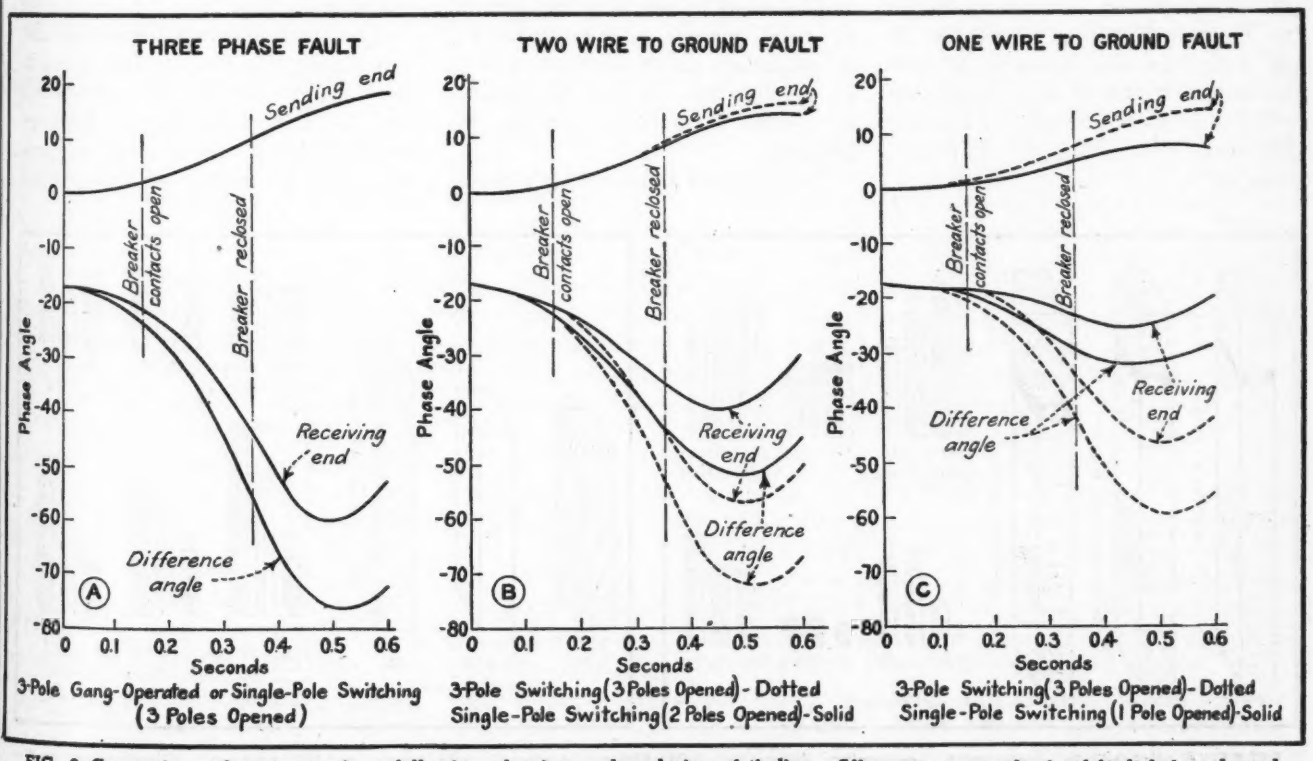


FIG. 2 Comparison of system swings following clearing and reclosing of tie-line. All curves are on basis of fault being cleared in 0.15 sec., reclosed in 0.35 sec. Note smallest phase angle of graph "C"

Chance for Distribution Savings Mostly Beyond Transformer

Analysis of typical square mile shows that quadrupling demand from one-half to two kva. dilutes secondary cost from ¾ to ½ total distribution cost including substations and primary system

GEORGE H. FIEDLER and FRANCIS E. DRAKE, JR., Rochester Gas & Electric Corp.

GREATEST POTENTIAL REDUCIONS in distribution costs lie on the secondary, that is, the customer's side of the distribution transformer. This is because that portion of the overall cost, consisting of meters, meter boxes, services, and secondary distribution, represents 74 percent of the total for a 500-va. user, 64 percent for a 1,000-va. user, and over 54 percent for a 2,000-va. user. For the largest of these three assumed demands (2,000 va.) the meters, service boxes and services constitute 32 percent, the secondaries 22 percent, the transformers 17 percent, the primary system 5 percent, and the substations 24 percent. These data were derived as a result of a study of theoretical distribution systems made for the Postwar Planning Committee of the American Gas Association (see the initial report of the Committee which is entitled "Competitive Factors Affecting Realization of Potential Markets").

The assumption has been made, and it is a practical assumption, that the dollar value of meters, service boxes and services is the same for loads of 500-va., 1000-va. and 2000-va., and therefore these items may be grouped. It is interesting to note, as shown, that this group goes to make up 46 percent of the cost of the 500-va. system, 41 percent of the cost of the 1,000-va. system, and 32 percent of the cost of the 2,000-va. system. Furthermore, for each layout they represent the largest percentage unit of investment.

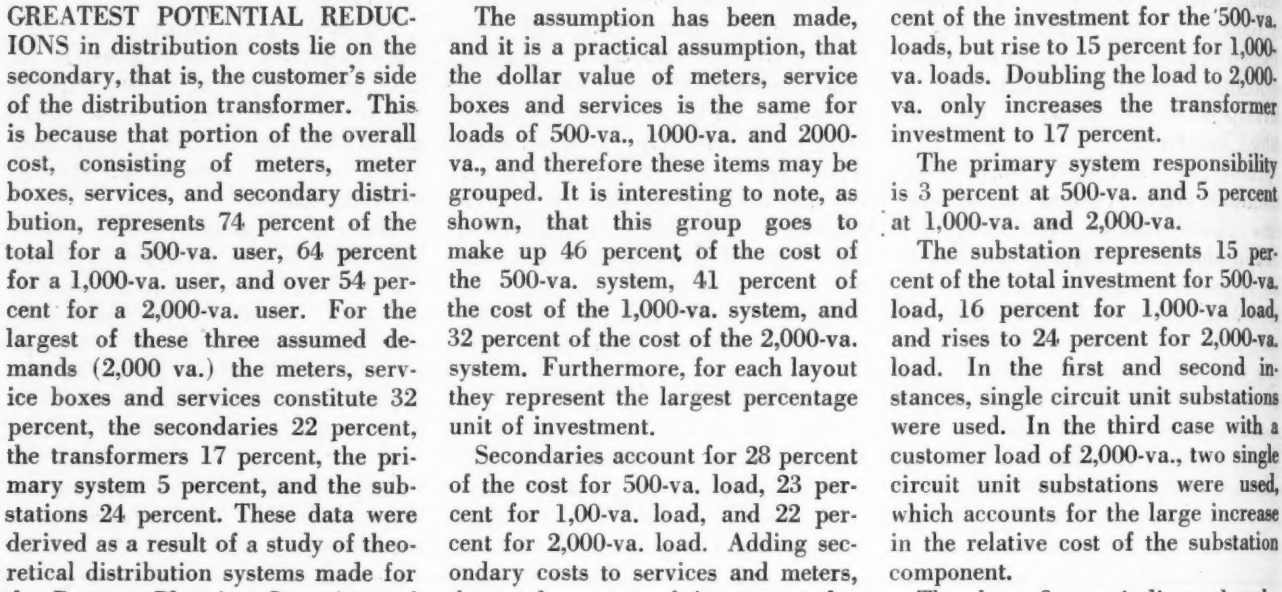
Secondaries account for 28 percent of the cost for 500-va. load, 23 percent for 1,00-va. load, and 22 percent for 2,000-va. load. Adding secondary costs to services and meters, the total percent of investment for the secondary distribution amounts to 74 percent for 500-va., 64 percent for 1,000-va., and 54 percent for 2,000-va.

Transformers represent only 8 percent of the investment for the 500-va. loads, but rise to 15 percent for 1,000-va. loads. Doubling the load to 2,000-va. only increases the transformer investment to 17 percent.

The primary system responsibility is 3 percent at 500-va. and 5 percent at 1,000-va. and 2,000-va.

The substation represents 15 percent of the total investment for 500-va. load, 16 percent for 1,000-va load, and rises to 24 percent for 2,000-va. load. In the first and second instances, single circuit unit substations were used. In the third case with a customer load of 2,000-va., two single circuit unit substations were used, which accounts for the large increase in the relative cost of the substation component.

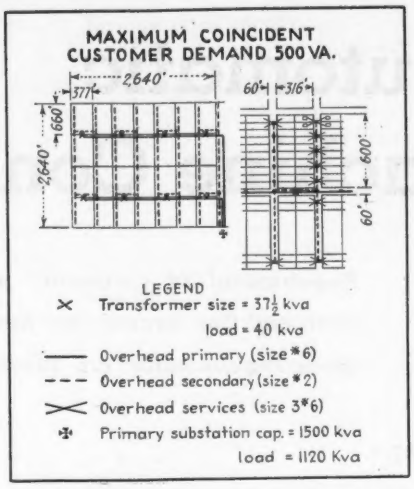
The above figures indicate that the opportunity for the greatest percentage saving lies on the customer's side of the transformer. Cheaper metering, lower cost services, and less expensive secondary systems would

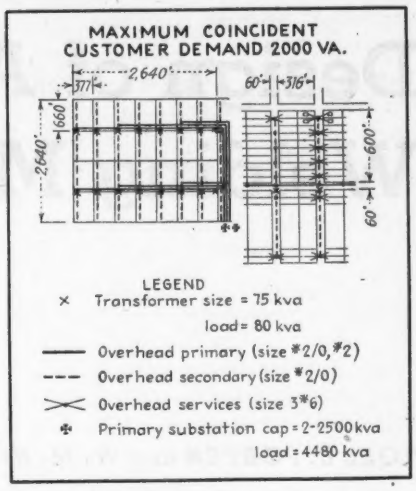


RELATIVE distribution costs with increasing demand; (left) 500-va. demand costs taken as 100 percent. Distribution cost components (right) in percent

materially reduce the costs, especially for customers with low loads. Two-wire services might be used with smaller secondaries if the flicker due to starting of motors could be reduced. It should be pointed out that the radial system has been considered in the development of these figures. By banking transformers, or possibly even networking the secondaries, some savings might result. However, cheaper equipment than now available would be necessary, as the reduction in wire size will not give a very large saving. It is interesting to note that the components on the customer's side of the transformers decrease as the load is increased, while the transformers, primaries, and substation costs increase with load. A reduction in the cost of large transformers would result in greater savings as loads increase. The primary system represents such a small percentage of the cost that little saving can be made here. In fact, primary systems will probably increase in cost as service reliability becomes more important.

It may be possible to build cheaper substations than used in the estimates by discarding unit type equipment. However, regulation must be provided, and a homemade substation will usually not result in a larger saving.





THEORETICAL distribution system for one square mile (only ¼ square mile shown). There are 112 blocks each 660 x 377 feet and the streets are 60 feet between property lines of lots 60 by 158 feet; 20 customers per block and 2,240 in the sq. mile

Effect of Increasing Demand

In comparing the relative distribution costs as customer demand is increased, all of the components of the 500-va. system were taken as 100 percent. Doubling the load from 500-va. to 1,000-va. increases the cost only 10 percent. Quadrupling the load to 2,000-va. increases the cost to 142 percent. The relative costs for the low voltage component are very nearly the same for all three systems. The transformers increase more nearly in proportion to the load as does the primary system for the 1,000-va. demand. Doubling the demand to 2,000 va., however, increases the primary cost from 180 to 220 percent above the 500-va. base, a 22 percent increase. Substation cost for the 1,000-va. system is only slightly greater than that for the 500 va., because the ratio of capacity to load for the standard units chosen is less at the higher load. Substation cost for the 2,000-va. system is double that for 1,000-va., as two units were used for service reliability. One large unit would show a reduced cost for the larger station.

The study is based on a theoretical square mile area, consisting of 112 blocks, with a total of 2,240 customers. Loads of 500, 1,000 and 2,000 va. maximum coincident demand per customer are considered. Schematic diagrams of a quarter-mile section and the blocks served from individual transformers are shown. The study assumes that all distribution facilities will be overhead, and that the 500-va. and 1,000-va. loads in the entire area will be supplied from one substation. Two unit stations are used to supply the 2,000-va. load. Cost estimates do not include any transmission facilities to the substation or any proportion of generating plant costs. The distribution systems are, in each case, designed to limit regulation and flicker to present day commercial standards, assuming that starting currents would remain about as they are now. Transformer sizes are such that the initial system will operate without serious overloads.

The 500-va. design assumes a 1,500-kva. substation supplying the total load of 1,120 kva. with a three-phase four-wire common neutral 2,400/4,160-volt primary system. This supplies 28-37½ kva. transformers, or a total capacity of 1,040 kva., allowing a peak overload of less than 10 percent. Secondaries are 3-wire No. 2 conductor not over 750 feet long. This limits maximum secondary drop to 3.5 percent. All 3-wire services of No. 6 conductor have been assumed, and 3-wire meters are used.

The 1,000-watt design assumes a 2,000-kva. station with forced air cooling, raising the rating to 2,500-kva. to serve the 2,240-kva. load. A 2,400/4,160-volt primary system supplies 56-37½ kva. transformers with similar load conditions. The secondary length has been reduced to 570 feet giving 3.5 percent drop. Services, meters, etc. are the same as the 500-va. system.

The 2,000-va. design assumes two 2,500-kva. substations supplying 56-75kva. transformers. The cost of the system might be reduced by the use of one station. However, if loads of this magnitude develop, service reliability will be increasingly important, and the maintenance of two unit substations with proper primary ties should assure continuity to all essential load with one unit out of service. The size of the secondary conductor has been increased to No. 2/0, giving 3.5 percent drop. Service and meter costs remain the same.

Radial systems have been assumed throughout with transformers not banked, and drops given are maximum to the last customer.

While it is not meant to infer that progress within the next few years may not materially change distribution design, this study indicates that it would be perfectly practical to carry loads through 2,000-va. with the present type radial system, unless heretofore undeveloped appliances demand closer voltage control or require much higher starting currents than are now encountered.

Design of Automatic Welding Machine Control

Requirement of automatic welding machine starters are set forth and five circuits that have been used in an attempt to meet these requirements are presented and analyzed

NOEL E. PORTER and W. M. NOTT*

THE TREMENDOUS INCREASE in the use of arc welding since the beginning of the war has drawn into sharp focus the large no-load losses of the individually operated heavy duty, a.c.-d.c. welding sets. The average 300-amp. motor-generator welder will draw from 2.5 to 4 kw. at a power factor ranging from 30 to 40 percent depending on the current and voltage settings, as well as the make of machine. These losses can be such a factor in electrical distribution systems that there is hardly a plant in the country using large numbers of welding machines where the electrical departments have not given some thought to the problem of reducing this wasted power with its inherently low power factor operation.

Pattern of Operation

At Richmond Shipyard No. 1 of the Permanente Metals Corporation the importance of this problem was recognized and studies were made of various methods for automatic control in order to determine the best method for equipping the welding machines in the yard.** All systems considered followed the same basic pattern; i.e., the welding machine was permitted to run idle for a short period after the arc was broken (partly to permit the operator to change rods or position without shutdown, partly to provide adequate cooling for the machine). When the machine was shut off, a low a.c. voltage was applied to the welding cable which provided power for starting by touching the rod to the work. The chief variation between circuits lay in the method used to take advantage of the difference between open and closed circuit conditions. All systems provided for measurement of arc time for weld checking and incentive purposes since the mechanics of this measurement are closely related to automatic control.

Make	Open Circuit Volts	Closed Circuit Volts
P. & H.	80	35
300 A. Lincoln	66	28
400 A. Lincoln	85	31
G. E.	80	25
Hobart	80	22
G. E. (a. c.)	75	30
Baby Lincoln	50	25
Hobart	80	40
Wilson Hornet	53	25
300 A. Lincoln	70	25
Westinghouse	40	25
Westinghouse	40	22
Hornet	70	25
Hobart	70	34
300 A. Lincoln	80	25
P. & H.	65	25
Baby Lincoln	47	30
P. & H.	65	31
Hobart	80	40
Hobart	80	34
Westinghouse	28	22
Westinghouse	28	25
300 A. Lincoln	66	28

TEST of terminal voltage and welding generators at open circuit under welding conditions. Machines picked at random from a large group

At first glance the problem seems comparatively simple. Examination of the problem involved, however, shows that there are a number of different requirements and desirable features which complicate the method of solution. In the opinion of the authors, these are as follows:

1. The starter, or automatic control, should be universal, i.e., applicable to any make of heavy duty set with little or no adjustment.

2. The welding machine must be under perfect control of the operator at the "stinger," even when the machine has just been cut off the line.

3. The starter must be more than sensitive enough to operate even when welding cable lengths up to 250 ft. are used. The fact that this cable may be coiled up on steel plate, resulting in a relatively high a.c. impedance, must be considered.

4. Any voltage applied to the cable to provide starting power should be so low that it would never constitute a hazard to the welder.

5. No extra wires paralleling the welding cable should be required because of large first cost and excessive maintenance.

6. It is desirable that introduction of the starter should not require any additional breaks in the welding cable because of the heavy currents used and the consequent effects of small contact resistances, plus additional maintenance costs.

Rugged Relay Needed

7. The time delay relay must be sufficiently rugged to withstand up to 2,000 actuations (not shutdowns) per day, and should be synchronous motor operated to insure a fixed time delay.

8. It should be imposible to operate the arc time totalizer during idling periods or while the rod is shorted to the work to avoid accidental or deliberate arc time registration.

9. Maintenance costs and frequency of necessary servicing should be kept to a minimum.

10. Cost of the unit, plus installation, should be sufficiently low to permit payment of the investment by power savings within approximately one year.

For the sake of brevity, the dia-

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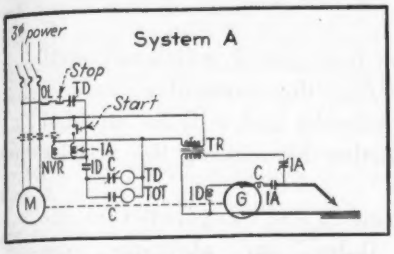
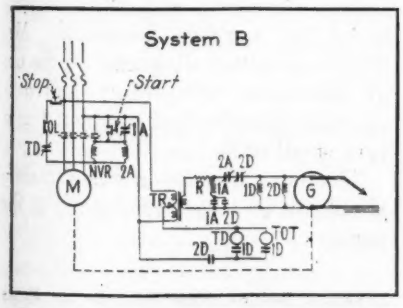
** ELECTRICAL WORLD, Feb. 5, 1944, p. 46; *Electrical Engineering*, Nov. 1943, p. 728.

grams shown are accompanied only by a brief explanation of the theory of the starting operation. Reference to the system of nomenclature will enable the reader to follow details of operation if desired. It may be assumed that each system described was found to satisfy the above requirements to a reasonable degree except for the ones mentioned.

Because of the large number of different makes and capacities of welding machines in the yard, flexibility of application was of primary importance. Design requirements of the various components of each system were also studied, since these play a large part in determining cost, sensitivity, and maintenance problems. After a careful review of all the considerations involved it was felt that System E was best suited to meet the conditions existing in the yard. Several hundred of these units have now been in operation for a number of months and experience has well justified the choice of circuit.



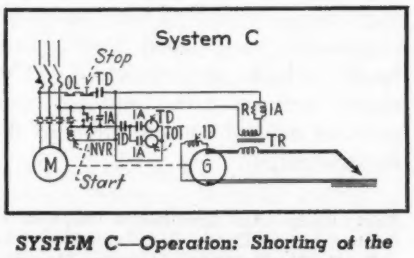
SYSTEM A—Operation: On standby, TR and NVR are in series. Short circuit results in reduction of voltage drop across TR sufficient to pick up NVR. TOT is actuated by C, and protected against short circuit registration by 1D which drops out at low voltage occurring under these conditions. TOT short circuit protection is the same on all systems described. Disadvantages: (6) A break is required in the welding cable. (10) It is to be expected that a relay, C, with 400-amp. contacts (to go on very heavy duty machines) which must operate 18 to 20 times per shift will require considerable maintenance. (11) Cost of a 400-amp. relay makes the unit rather expensive to be considered for wartime use.



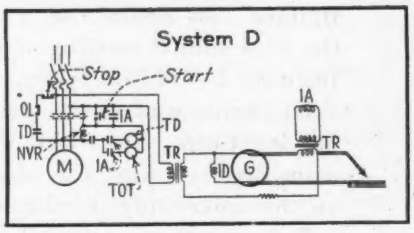
SYSTEM B—Operation: Shorting of the rod actuates 1A due to voltage drop caused by heavy current drawn through R. Relay 1D is used to energize TD on normal open circuit voltage, and TOT on normal welding voltage. Other contacts shown are for interlocking and protective purposes. Disadvantages: (1) Generator impedances go as low as 0.4 ohms, while cable impedances go as high as 0.3 ohms, necessitating critical adjustment of 1A and R on some machines and making the unit subject to self-starting. In average cases adjustment does not have to be so critical. From this standpoint the unit is not a true universal control. (2) When the machine has been cut off the line it cannot be started again until it has come to a stop. To a man ready to work, this slight delay can be quite irritating. (3) Relay 1D is usually adjusted for operation between 40 and 50 volts. The accompanying table demonstrates the possibility of recording arc time unintentionally or deliberately by low open circuit voltage. Conversely, heavy welding currents through small resistances can cause generator voltage to be sufficiently high to result in TD operation rather than TOT operation while welding is in progress

Symbols

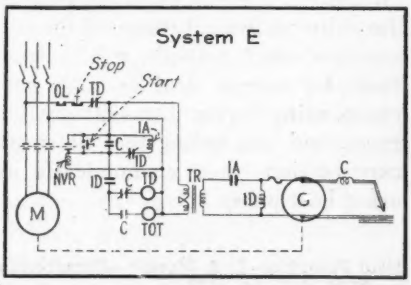
M	— a. c. motor
G	— welding generator
TR	— transformers
TD	— time delay relay
TOT	— synchronous motor operated hour counter for totalizing arc time
NVR	— no voltage release relay
OL	— overload relay
C	— relay actuated by current in welding cable
1D, 2D	— d. c. voltage relays
1A, 2A	— a. c. voltage relays



SYSTEM C—Operation: Shorting of the rod results in a change of the magnetizing impedance of TR due to saturation of the core, causing 1A to pick up. During welding, the direct current passing through the secondary saturates the core which also actuates 1A to register arc time. Disadvantages: (1) Due to a wide variation of generator impedances, some adjustment of R is usually necessary in different makes of machines. From the cost standpoint, it is desirable to use two or more different sizes of transformers for various impedance ranges. In this respect this system is not truly universal. (6) A break in the welding cable is required. (10) Cost of the transformer involved (6 to 8 sq. in. of core area, wound with 400-amp. secondary) makes the unit rather expensive, though not necessarily prohibitive in sections subject to higher than average power rates



SYSTEM D—Operation: This is a modification of system C, the essential difference being that the transformer is excited from a low voltage source with series resistor. The starting operation causes relay 1A to drop out and start the welder. Other operations are essentially the same. Disadvantages: (1) Require adjustment as described under system C. (6) A break in the welding cable is required. (10) While a smaller main transformer is required, an excitation transformer with 400-amp. secondary is added, so the saving in cost is doubtful



System E—Operation: Shorting the rod picks up relay C which in turn short circuits coil of 1A, causing that relay to drop out for transformer protection and at the same time picking up NVR. Disadvantages: (3) Sensitivity depends largely on relay C, and improper design of this relay reduces it below the safety point. Careful design, however, can give an adequate margin of safety. (6) Although the diagram indicates a break in the cable, this is not actually an objection for this unit, since in practice relay C is equipped with an external laminated yoke through which the welding cable itself is looped several times

Literature of the Heat Pump

Bibliography and abstracts of articles published in American and foreign periodicals in past 25 years present summary information on heat pump design and application

Since publication in the June 10, 1944, issue of the article, "The Heat Pump as a Load Builder", an abstract of a paper presented at the 1944 annual meeting of the Edison Electric Institute by Philip Sporn, vice-president and chief engineer of the American Gas & Electric Service Corp., Electrical World has received many letters asking for additional information on this interesting development.

Believing that a comprehensive review of the available periodical literature on the subject would be useful to these inquirers and to other readers, the editors have had compiled the following bibliography, each reference accompanied by a brief abstract of the contents of the designated article. It is believed that this presentation covers the different forms and applications of the heat pump sufficiently well that readers may find the particular features that engage their interest and will be enabled to pursue them further by reading the articles abstracted.

The list of references was compiled from the "Industrial Arts Index" and abstracts were made from bound volumes of the periodicals in the Engineering Societies Library, 29 West 39th St., New York City. Readers desiring to consult references which may not be available locally should apply to the Library. Members of the four "Founder Societies"—AIEE, ASME, ASCE and AIMME—may draw out volumes from the Library; non-members may obtain photostatic copies of designated articles at small cost.

Heat Pump in Theory and Practice—F. Krauss—*Power, p. 298-300. Feb. 22, 1921.*

Dealing with industrial application for boiling and concentrating liquids, the writer shows advantage of the system over other methods, and analyses cycle for simple distiller with heat pump, using temperature-entropy diagram, and concluding that the work may be done most economically by using heat pump.

Heat Pumping—T. B. Morely—*Engineering, p. 27-29. July 14, 1922.*

Term "heat pump" is restricted to evaporating processes. Performance data is given, and a number of variations in equipment to meet different conditions are shown, with diagrams. Use in drying fuel is covered. Several industries—chemical, sugar refining, brewing, paper making, water distilling—have applied heat pump successfully.

Heat Pump in the Operation of Evaporators: Vapor Compression and Steam-Pressure Transformation—*Mechanical Engineering, p. 635. Aug., 1928. Abstract from A. Oetkin—Die Warme, vol. 51, p. 315-321.*

Gives curves of steam consumption for vapor compression plant working with live steam, and diagrams of three types of evaporator plant. Conditions warranting the use of heat pump for evaporation are listed under four heads, which are discussed. The choice between turbo and jet compressors depend on conditions of the local situation.

Heat Pump—An Economical Method of Producing Low Grade Heat from Electricity—T. G. N. Haldane—*Institute Electrical Engineer's Journal, p. 66-675. June, 1930. Same—Engineers & Engineering, p. 64-72. March, 1930. Excerpts, Electrical Review (London), p. 1161-1162, Dec. 27, 1929. Electrical World, p. 315-316. Aug. 16, 1930.*

Theoretical considerations and practical tests are cited to show that, where heat at comparatively low temperatures is required, high efficiencies are obtainable with the heat pump. Application to heating buildings is discussed, estimates for heating equipment for a public bath are given, and two years' experiments at the author's home, demonstrating soundness of general principles, are cited as experience data.

Discussion: *Institute of Electrical Engineer's Journal, p. 676-685, 702-703, 1075-1077. June and Aug., 1930.*

Messrs. Ferranti, Betts, Chew, Bolton, Baker, Marchant, and Stoble contributed to earlier discussion. Mr. Stoble submitted diagrams on the use of alternative refrigerants, and data on tests which he had conducted on a very small unit.

The later discussion turns mainly about use of term "efficiency" in the paper.

Reverses Refrigeration Process for House Heating—*Electrical World, p. 315-316. Aug. 16, 1930.*

Briefly reviews paper by T. G. N. Haldane, adding curves comparing actual efficiencies obtained in his home installation with theoretical results and with actual results in large experimental installations.

House Heating Efficiency with Inverted Cdrnot Cycle—C. I. Hall—*Electrical World, p. 967. Nov. 22, 1930.*

In a letter, evoked by an editorial on Sept. 20, re: Mr. Haldane's work, Mr. Hall, of Hall Electric Co., Philadel-

phia, asserts doubt of applicability of reversed Carnot cycle to heating New York city homes under winter conditions.

Reversed Refrigeration Cycle for House Heating — T. G. N. Haldane — *Electrical World, p. 782. April 25, 1931.*

In correspondence, Mr. Haldane acknowledges some difficulties in applying reversed cycle for winter heating in our northern states, and makes suggestions for neutralizing them, particularly by group cooperation on private or commercial basis. Urges exploitation by refrigerator makers.

Hot Water and Cold Air from a Refrigerating System—B. F. Randel—*Power, p. 779. May 19, 1931.*

The writer explains, with diagram of equipment, a plan which he has developed for utilizing waste heat from an air cooling system.

For Heating Dwellings

Refrigeration Machine as a Heat Pump for Warming Dwellings—E. Guarini—*Heating, Piping and Air Conditioning, p. 132. System explained—H. J. Macintire, p. 133-4. Feb., 1931.*

P. H. McCarthy, Consul at Milan, reports lecture by Guarini, who had for several years advocated the system as a means for reducing Italian coal imports and providing low priced market for current in hours of low consumption.

Macintire explains direct and reversed cycles, with illustrative problem, and cites practical objections to system.

Discussion of Reversed Refrigeration—W. M. Benjamin—*Heating and Ventilating, p. 45-48. Nov., 1931.*

Mr. Benjamin of Detroit Edison Co. presents calculations showing inconsistencies in a previous, optimistic article, and estimates probable requirements in machinery for heating an ordinary dwelling. System is more efficient in mild climates. Development of heat pump not requiring such elaborate heat transfer apparatus is recommended.

Theoretical Consideration of the Value of Low Temperature Heat—W. C. Johnson, Jr.—*General Electric Review, p. 227-229. April, 1932.*

A clear statement is presented of the theoretical background of the heat pump, with relation to the fundamental laws of thermodynamics. Interesting analogies are listed. Saving of waste of high-grade and low-grade energy is emphasized. Heat pump utilizes heat stored at ordinary atmospheric temperatures.

Improved Inverted Refrigeration Cycle for Summer and Winter Air Conditioning—H. J. Stoever—*Heating, Piping & Air Conditioning, p. 412-415. June, 1932.*

Pointing out that performance is greatly influenced by the thermodynamic cycle of operations, the writer suggests practical improvements in the cycle, supporting his thesis with diagrams of equipment and corresponding temperature—entropy charts.

Heating with Refrigerating Machines and Diesel Engines—P. A. Willis—*Heating & Ventilating, p. 52-53. Jan., 1932.*

Referring to Mr. Benjamin's article in Nov., 1931, issue, Prof. Willis points out the possibilities of improving overall efficiency of commercial installations by substituting diesel engine for motor drive, and utilizing waste heat from jacket and exhaust to supplement heat pump.

Heating with Refrigerating Equipment Cuts Current Costs—H. L. Doolittle, Chemical Designing Engineer, Southern California Edison Co., Ltd.—*Power, p. 29-31. July 1932.*

Tests on the first large-scale installation of refrigeration heat, that at the Los Angeles office building of the Southern California Edison Co., are reported. Five tables show averages of observations made and results computed for eight test runs. Large saving over direct electric heating is shown.

Utility Office Application

Heat Pump Shows 2.8 Coefficient of Performance: Southern California Edison Installs Complete Air Conditioning Plant in Los Angeles Office Building — *Electrical World, p. 502-505. March 12, 1932.*

This article lists and describes mechanical equipment in the new So. Cal. Edison Building, with pictures of outstanding features, and diagrams of equipment and cycles.

Application of Refrigeration to Heating and Cooling of Homes—A. R. Stevenson, Jr., F. H. Faust, and F. W. Roessler—*Refrigeration Engineering, p. 83-90, Feb., 1932. Same: General Electric Review, p. 145-153. March, 1932. Same: Heating & Ventilating, p. 31-37. Feb., 1932. Excerpts: Domestic Engineering, p. 33-36, Mar. 19, 1932, p. 30-31, Apr. 30, 1932. Discussion: Refrigeration Engineering, p. 218, 224 & 235. Apr., 1932.*

Indicates reasons for slow progress, and technical difficulties. Gives some requisites for bodily well-being to be considered; and useful charts and tables, including temperature variations and cost data for four sections of the U. S. An appendix on the performance of gas-heated absorption machines, and a bibliography including historical and general items and current articles, are added.

In discussion, Mr. H. J. Macintire submitted a table showing effect of temperature range; Mr. C. G. Mowrey made several suggestions for improvements—in general limited by conditions; and Mr. W. H. Carrier pointed out limitations.

Performance in Batch Heating

Batch Heating with a Variable Performance Heat Pump—Abstract—J. C. Stoble—*Mechanical Engineering, p. 63-64, aJn., 1932. Abstract of Mr. Stoble's article in Journal of Institution of Engineers, Australia.*

Author claims much better performance is secured by heating material in batches, allowing temperature of condenser to increase gradually with that of body being heated. Substantiates this by tests, using small refrigerator to heat water. Test arrangement is described, and three of the author's cuts are reproduced.

House Heated by Pump with 5 to 1 Pick Up Ratio—G. Wilkes and R. E. Marbury—*Electrical World, p. 828-831. Dec. 17, 1932.*

Deals with experiments conducted at a bungalow and a dwelling by Westinghouse Electric and Manufacturing Co., and mentions further proposed studies. Charts show temperature regulation for 3-day and 7-day periods. The tests were designed to show to what extent the system is applicable, and tables of temperature regulation under severe weather conditions are included.

Steam Pressure Transformer—Abstract—T. B. Morley—*Mechanical Engineering, p. 258-259, Apr., 1933. Abstract from Steam Engineering, p. 205-207, Feb., 1933.*

This article mentions the application of the jet compressor, a form of heat pump, to raising pressure and temperature of exhaust steam, using comparatively little live steam; compares it with other apparatus, and lists other uses for which it has been employed.

Science Reverses the Refrigeration Cycle and Gives Us the Heat Pump—C. D. Graham and G. Wilkes—*Domestic Engi-*

neering, p. 55, 56, 59 & 65. March, 1933.

Two series of tests, one on equipment installed in a bungalow, the other in a residence, were made by the Westinghouse Electric and Manufacturing Co. for experimental purposes. These are described, and results are indicated. A diagram, illustrations, and two tables of temperature regulation are given.

Reversed Cooling for Heat, an Economical Combination — C. D. Graham — *Electrical World, p. 533-537. Oct. 21, 1933.*

Presents conclusions, based on experimental research and theoretical analysis, regarding economy of heat pump compared with direct heating by electricity and fuels. Discusses effect of different temperature gradients. Relative costs for a domestic installation are considered, with prospects tending toward wider use of heat pump, especially in connection with year-around air conditioning.

Power Storage Suggestion

New Heat Storage System Development in Europe — F. Marguere — *Power Plant Engineering, p. 426-427. Oct., 1933.*
Power Accumulation by Thermal Storage —Abstract—F. Marguere—*Electrician, p. 294. Sept. 7, 1934.*
Heat Temperature Storage of Power—Abstract—*Engineering, p. 721. Dec. 28, 1934.*

(The first article listed is derived from a description of his plan by Mr. Marguere in Escher-Wyss News. The others are abstracts of a paper presented by him in Aug., 1934, at Zurich congress of International Union of the Producers and Distributors of Electrical Energy.)

Mr. Marguere, chief engineer of a power station at Mannheim operating at 1,400 lbs. per sq. in. steam pressure, describes an application of the principle of the heat pump to low first cost and practical storage of night energy from steam or hydraulic plants, for use at peak loads. He outlines an installation of 15,000 kw., to provide for a 4-hour, 30,000 kwh. peak load. The plan had not been put into practice, but all its elements had been tried out in analogous operations.

Boilers and Heat Pumps—*Engineering, p. 669-670. Dec. 30, 1932. Abstract—Mechanical Engineering, p. 259-260. Apr., 1933.*

Editorial explains principles of heat pump, to obviate hopes of unrealizable thermodynamic gain. Shows fallacy of using heat pump to deliver heat to boiler furnace.

Heating and Air Conditioning Buildings with Reversed Refrigeration Cycle—C. F. Mowrey—*Heating Piping & Air Conditioning, p. 257-260, 295-297. June-July, 1934.*

These articles assert the advantages of gas engine drive for heat pump, outline an arrangement for warm air heating, with control methods, using same equipment for cooling in summer. Application to several variations of heating system is suggested, and objections considered.

Hot Water from Reversed Refrigeration—B. J. Homkes—*Electrical World, p. 140-142. Aug. 4, 1934.*

An illustration shows compact refrigeration compressor adapted to water heating by reversed refrigeration, with parts designated. This unit was tested by the Westinghouse Co. in a "home of tomorrow" at Mansfield, Ohio. Equipment and procedure are described, and some details of test results are given.

Domestic Hot Water by Reversed Cycle—G. M. Wilkes—*Electrical World, p. 970-972. Nov. 24, 1934.*

Describes a small heat pump installation, serving eight persons, in service for over two years, which had been assembled from available used equipment. Experience with this installation led to a new design, from which better performance and reduced cost are expected.

Using the Reversed Refrigerating Cycle for a Self-Contained Heating and Cooling unit—H. L. Galson—*Heating, Piping & Air Conditioning, p. 499-502. Oct., 1935.*

Discusses performance of self-contained air conditioner with air cooled condenser, equipped for reverse cycle heating. Gives example of an office of 5,000 cu. ft. content. Details affecting design are discussed. Application to railroad cars is also illustrated.

For Hot Water Service

Reversed Refrigeration Water Heater—Hot Water from 6-10 Kw.-Hr. Daily—G. Wilkes —*Electrical World, p. 2476. Oct. 12, 1935.*

Shows illustration of self-contained 50-gal. units, and gives performance curves for three daily draw-offs.

Jersey Utility Building Heated and Cooled by Heat Pump; Plant Has New Features. *Heating & Ventilating, p. 58. Jan., 1935.*

Briefly summarizes features of the Salem, N. J., installation of Atlantic City Electric Co.

Unit Cooler and the Heat Pump—J. Askin —*Refrigeration Engineering, p. 72-74. Aug., 1935.*

Recommends use of unit coolers as condensers and absorbers in heating and air conditioning installations, and shows by diagrams and explanations how this type of equipment may be installed most advantageously, with 3-way solenoid valves for automatic regulation.

All Electric Heating, Cooling and Air Conditioning System — P. Sporn & D. W. McLanegan—*Heating, Piping & Air Conditioning, p. 402-409. Aug., 1935.*
Abstract: Heating & Ventilating, p. 56-57. July, 1935.

The paper describes equipment and performance of plant using heat pump in heating, cooling and air conditioning of The Salem, N. J. office building of Atlantic City Electric Co., for the year around. It is illustrated with pictures, diagrams and charts, with a table of performance data for a winter month.

Ice Making By-Product

Year 'Round Air Conditioning for Virginia Electric & Power—G. E. Tuckerman—*Refrigeration Engineering, p. 48-49. Jan., 1936.*

This company produces ice as part of its business, and in moving their Williamsburg plant decided to use the reversed refrigeration process for winter heating. There is additional equipment for the most severe weather, including wall type room heaters which were rarely used.

Le Fonctionnement et l'Utilisation des Pompes a Chaleur a Compresseur Centrifuge de Vapeur d'Eau—M. Chambadal—*Societe Ingenuirs Civils Memoires, p. 584-617. July, 1936.*

The author includes both refrigeration and heating processes in his discussion, and classifies heat pumps under two types—closed circuit and open circuit. Under the former, he gives diagrams and theoretical discussion of distilling and concentrating applications. Under the latter, he gives similar analyses of refrigerating applications, with less emphasis on the reversed Carnot cycle.

Central District Heating and Cooling—E. A. Lynette—*Refrigeration Engineering p. 7-11, 37. Jan., 1938.*
Discussion, p. 37, 64. Jan., 1938.

This paper proposes a system using the heat pump for district heating in the city of Knoxville, Tenn. Much space is given to temperature studies and estimates of heating require-

ments and demands. The plan contemplated use of the system for air-conditioning in summer, and heating in winter.

Discussion emphasizes necessity for caution.

Heat Pump Applied to Railway Cars—G. Lang—*Refrigeration Engineering, p. 240-268. April, 1939.*

The writer, a Budapest engineer, after a general discussion of the principles, in practical application, of the heat pump, proceeds to describe its specific use for heating and air conditioning cars of the Egyptian State Railways.

Heat Pump Serves New Coast Building: Cooling and Heating by Reverse Cycle Operation at Westinghouse Building, Emeryville, Cal. *Power, p. 215-217. April, 1939.*

The heat pump is shown to be most advantageously applied in moderate climates, success depending on thermal and economic considerations rather than mechanical design. Favorable conditions at Emeryville are indicated, and the installation is described, with plans and diagrams.

Seattle with Low Electrical Rates Develops its Own Heat Pump—*Heating & Ventilating, p. 61. Sept., 1939.*

A news dispatch from Seattle notes work being done in the shops of City Light on development of low priced heat pump equipment for general use in residences.

Heat From River Water

Warmepumpinheizung im Zuricherrathaus —W. Kruger—*V. D. I., p. 654. May 27, 1939.*

Explains the logical selection of the system, with an ample heat source in river water, and gives cross-sectional diagram of the installation with outline of operation. Provision for additional heating in severe weather is noted, and adaptability of the equipment for cooling in warm weather.

Warming the Walls by Reverse Cycle—*Electrical West, p. 48. Oct., 1939.*

Illustrations and brief description cover unusual heat pump installation in the home of C. E. Boggs of the Idaho Power Co., Boise, Idaho. Compactness of architecture and thorough insulation aid in success of the system, which draws heat from well water. Heat from condensing Freon is transmitted into plaster of walls by means of some 6,000 feet of copper tubing laid on both before plastering.

Heating by Reverse Refrigeration: United Illuminating Co. Administration and Service Building, New Haven, Conn.—A. J. Lawless—*Heating Piping & Air Conditioning, p. 473-476, 519-521. Aug.-Sept., 1940.*

Deriving heat from private wells, this heat pump system provides space heating for temperatures down to 20 deg. F.; it is then supplemented by other provision. The design, operation and control are described, with simplified diagram of entire heating and cooling system, and illustrations.

Heated by Reverse Cycle Refrigeration—K. M. Fisher—*Domestic Engineering, p. 50-51, June, 1940.*

Describes equipment for summer cooling and winter heating at office building of Southern Sierras Power Co. at Los Angeles, Cal. Heat is available from well water. Operating costs are moderate, and the designers have installed a similar system in their own building.

In New England Climate

Experience with a Reversed-Cycle Heating System: Administration and Service Building of the United Illuminating Co., New Haven. *Power, p. 557-559. Aug., 1941.*

The equipment, which had been in service for more than a year, is described, and its operation in summer and winter is summarized, with some data. The installation is of special interest because of severe weather conditions in New England, and its selection depended upon an adequate heat supply from well water.

Reversed-Cycle Refrigeration for Air Conditioning Work—R. D. Heitchue—*Refrigeration Engineering, p. 217-320, 334. May, 1941.*

Covers practical considerations justifying use of heat pump, with special reference to the importance of heat source in determining economy; descriptions of two applications to commercial buildings; and a detailed account of residential window unit. Illustrations are good, particularly five showing small home unit, diagrams of its operation, and control valve.

South American Way on This Buenos Aires Job Was to Use a Heat Pump—M. A. Ramsey—*Heating, Piping & Air Conditioning, p. 167-170. March, 1941.*

Weather and other conditions here are almost ideal for heat pump, and the article describes a wholly automatic installation for a 700 seat movie theatre, with continuous heating or cooling. Equipment, in some points unusual, is described, and a table of hours of operation and kw.-hr. for heating and cooling for a nine month period is presented.

Heating by Reversed Refrigeration—R. D. Heitchue—*Electrical Engineering, p. 556-560. Nov., 1942.*

Outlines technical requirements and elements of operating costs. Describes installations of Westinghouse at Emeryville, Cal., and United Illuminating Co. at New Haven, Conn.—the latter probably the largest such heating plant. A simple type of residential installation, for one room, is illustrated.

Heat Pump—T. F. Wall—*Engineering, p. 221. Mar. 19, 1943.*

Diagrams are presented showing application of heat pump for heating of rooms and for distillation processes. Two recent successful installations in Zurich, Switzerland are described—one for heating air and water at the swimming hall, the other for heating the Rathaus.

Reverse Refrigeration Cycle for Winter and Summer Air Conditioning—H. R. Sewell—*Refrigeration Engineering, p. 328-330. May, 1943.*

Considers factors favoring and restricting employment of reverse cycle, gives some details on the Southern California Edison equipment at Los Angeles, and presents comparisons of three refrigerants—carbon dioxide, ammonia, and methyl chloride—in connection with choice of the latter.

Heat Pump: An All Electric Year-Round Air-Conditioning System—P. Sporn and E. R. Ambrose—*Heating & Ventilating, p. 68-78. Jan., 1944.*

Heat pump cycle is explained, and four types of systems, based on heat source and fluid to be heated, are shown in diagrams, with suggestions on selection of type and precautions to be observed. Design factors are discussed, and installations at Steubenville, Ohio, Pikeville, Ky., Pitman, N. J., and Logan, W. Va., are described. Advantages of the heat pump are listed, and cost comparisons are presented.

Editorials

S. B. WILLIAMS, *Editor*

No Comfortable Sales Program After the War

FOR THE FIRST TIME in more than five years the weekly output of electrical energy has failed to establish a new high for a particular week. The Labor Day week dropped behind the figure for 1943 by a million kilowatt-hours. This is but a forerunner of what the industry has before it when war production ceases.

There are some who feel that the amount of excess capacity which the industry will have for sale after the war will not be large, while others place it as high as 10,000,000 kw. None, however, will deny the fact that energy sales to industry will fall off. Peacetime manufacture has never produced the high load factors of war. This is reflected in the use of generating capacity. Last year, for instance, the number of kilowatt-hours per kilowatt of capacity were over 4,600; in 1929 they were only 3,000. Any such decrease, if applied to the more than 50,000,000 kw. of generating capacity now in service would mean a drop of 75 billion kw.hr., or as much energy as the industry sold in 1929 for all purposes. And the total even then would be 20 billion kilowatt-hours, or 15 percent greater than the highest pre-war year.

Even if the decrease should be but half that amount, bringing the total production up to the 1942 output, it will still require the biggest selling job the industry has ever tackled to bring the volume back to that of today. It is today's record that will make tomorrow's objective. For that reason goals must be made which will bring the sales volume back quickly. Is five years too short a time to expect sales to equal those of today? The only time the industry took longer to return to previous records was in the depression and then it was six years.

Where is the added consumption coming from to make up the forty to seventy-five billion kilowatt-hour deficit or maybe even more? Is it too much to expect a large share to come from residential load, the promotion of which has been dormant during the war? The consumption of this class of customer doubled during the depression decade. How much better can it do after the war when people are employed and have money? In the five war years it increased some 50 percent with nothing to sell most of the time. Is it too much to try to increase 100 percent when appliances are once more available?

Even if the goal is not reached the sales volume surely will be much further ahead at the end of five years than it would be with a more comfortable program. But there can be no comfortable program after the war. The war has set new records which in terms of pre-war activities are enormous. To pass them we must have goals that are born in vision—and which will be won in sweat.

Rules for the Rural Electrification Race

THE SIGNAL to those who would enter the big race for rural electrification territory to be on their mark and get set was given in the past two weeks in a series of regional REA conferences with project heads and material suppliers. At the same time one of the rules of the race was laid down by the Secretary of Agriculture under whose jurisdiction is REA.

It is too bad that all the rules of the race could not have been given the contestants at the same time and that the rules were those mutually agreed on by both REA and the power companies as fair. For one side to say what will and will not be permitted smacks too much of an ultimatum, even if it is a proposition that fairminded men would agree is reasonable.

Farmers were told by Secretary Wickard that REA could do the entire remaining job of extending rural service and that they should not sign up with utility companies in any area unless the companies would make service available to all farms in that area. That makes sense as far as it goes but it gives no assurance that there will be no competition within areas. Is REA ready to respect power companies' claims to certain areas? It would seem as though there is some principle here that might be worked out jointly.

After all, there is an REA act and it does specifically provide for extending lines to farms unable to secure service from power companies. It recognizes, in other words, that there is an economic limit to which privately financed operations can go and provides means whereby those beyond that limit might still receive service. The economic limits of the thirties have been pushed back by the war because of the new emphasis placed upon the use of electricity in farm work, so that the areas that might receive central station service are greater. Are these areas going to be recognized by both sides, or are we going to have another territory-grabbing battle and let the devil take the hindmost?

The utilities ought to know by now what their economic limits are and be able to map out areas that they are prepared to serve within a five-year period or less. Be-

yond that territory they should make no claims but, as we have said before, should help the farmers so located to get service through REA financing. If REA is to operate within the spirit of the act the utilties, in their avowed service areas should be assured of no interference provided they made service available to all and did so reasonably promptly.

If this is done a start will have been made toward greatly reducing the animosity that now exists and which does the rural electrification movement more harm than good. If the important thing is to help farmers get electric service as fast as possible, then let each do the job he is set up to do and is best fitted for and stop trying to hamstring the other.

Retroactive Write-down of Surplus

A RECENT DECISION of the district court for the Southern District of New York, holding that if property records of a company are correct when made a commission cannot retroactively apply a new system to write down the company's surplus, is significant on several counts.

The property referred to was some telephone toll plant and instruments transferred nearly twenty years ago by the parent telephone company to a subsidiary at a price in excess of original cost. At the time of the transaction the accounting was subject to regulation by the Interstate Commerce Commission and was correct. Later the Federal Communications Commission took over and adopted a new system of uniform accounts.

This case parallels many of the acquisition transactions in the power industry. The properties were placed on the books at purchase price and the transactions approved by the only regulatory body in existence—a state commission. The prices paid were admittedly in excess of the original cost but the increment in value in most cases was justified by the essentiality of the property to the system.

Another parallel lies in the transfer of property by a holding company to a subsidiary, where the assumption has been that such transfers can never represent true increment of value.

The decision, of course, does not justify mark-ups that do not represent a true increment of value. Where values have been arbitrarily boosted a different situation entirely exists.

There is much to be said in favor of maintaining books on the basis of original cost, but there is little to be said for the fairness of applying the theory retroactively, especially after transactions have been approved by properly constituted regulatory bodies. To be forced to write down surplus on acquisitions approved at the time and before the adoption of the accounting regulations that call for original cost has always seemed arbitrary, which opinion appears to be confirmed by this latest legal decision.

Another Conflict of Federal With State Authority

ANOTHER INTERESTING CASE of conflict of jurisdiction of FPC with a state commission is in the making in Connecticut. It involves an intrastate sale of energy from a line that is interstate fed.

The Connecticut Power Company had secured the approval to increase its rates for wholesale energy to the Torrington Electric Light Company and the new rates were acceptable to the latter. The Federal Power Commission nevertheless ordered the increase suspended for six months and called a hearing for December in Washington on the grounds that the new rates might impose an "undue burden" upon Torrington's retail consumers. An amount of a little over one hundred thousand dollars a year, or 18 percent, is involved.

The claim of FPC is that the line from which Torrington gets its energy goes from Southwest Massachusetts where it is owned and served by the Western Massachusetts Companies, through Connecticut where it is owned and served by Connecticut Power and also served by Hartford Electric, on into New York ending at Poughkeepsie where it is owned and served by Central Hudson Gas & Electric. With generating systems in three states pouring energy into the line the Commission believes it has a clear cut case of interstate business and therefore jurisdiction.

Connecticut Electric, on the other hand, states that all the energy it sold to Torrington it has purchased from Hartford Electric which supplied this requirement from its Hartford steam station. On that basis an entirely intrastate transaction is claimed.

The point involved here is not new. Can kilowatt- hours be traced? Obviously, there is nothing to distinguish one kilowatt-hour from another, but there is a simple way of showing flow and that is by a meter. Why do we have to complicate the transaction by trying to show that because other energy is on the line the kilowatt-hours received are not the same as those generated for this customer? Surely there is some rule of logic that can be used to determine what is and what is not an interstate transaction.

If Connecticut Power had been serving Torrington from a single line built for that purpose there could be no question about the character of the service. Instead it elects to use the more practical and economical method of a transmission line that at points beyond both customer and seller is fed by companies in other states. It is difficult to see how that changes the character of the operation.

More important, however, is the invasion of the jurisdiction of a state commission. It is doubtful if FPC was meant to have any authority in a case such as this where there is a state regulatory body that is competent to act and has acted. If the Commission is successful there will be nothing to stop it exercising authority over virtually all wholesale rates for energy taken from a transmission line and sold at resale because of the likelihood that somewhere those lines have an interstate tie.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Utility Place in Rural Electrification Challenged

AGRICULTURAL Secretary Claude R. Wickard, who makes policy for the Rural Electrification Administration, took the gloves off recently and threw one of them at the feet of the electric power industry by challenging its place in the post-war construction of rural lines.

Wickard told a cooperative audience in Wisconsin that electric utilities should not be allowed to build lines which fail to serve every farm home in a given area. He said in effect that REA is prepared to serve every farm home in the land—at a profit or at a loss—and that private companies must not be allowed in on the program unless they are willing to do the same job that REA proposes to do with its tax-exempt, low-interest money.

Effect of Act

The Wickard pronouncement is a far cry from the REA act, whose Section 2 empowers REA to make loans for the furnishing of electric service to rural people not receiving central station service. The "central station" qualification of Section 2—which was deliberately included as a protection for utilities—would be junked completely by the Wickard reasoning, for under that reasoning, private capital could go into rural lines only on the same basis that cheap government subsidy capital goes in. On this basis, the reasoning goes, few farms not now receiving central station service ever would receive it, and the rural field would be reserved for REA. This, of course, is not what Wickard would attempt to bring about or even like to see.

Wickard's point was not aimed directly at the various state commissions which will grant whatever certificates are required for the extensive rural construction which is bound to follow this war. It was aimed rather at the farmers themselves, many of whom will be given the opportunity to get central station service at rates they can afford and at a time when there is money available for wiring jobs and household and farm appliances.

"If we permit cream skimming of all the good territories, a lot of people are going to be left without the benefits of electricity," Wickard said, terming it "unfair and unamerican to let anything occur which will deprive rural people of anything as vital as electric service. We farmers . . . are the only one who can prevent that very thing . . ."

Wickard then laid on the table REA's reasons why it will be able to do the entire job. He noted final passage of the Pace bill, which extends REA's life indefinitely, authorizes unlimited appropriations or loan funds for the agency, extends repayment to a 35-year term and lops about a half of one percent off the interest rate. Though it sounds like mumbo-jumbo it really greases the skids on which fat REA appropriation bills can be zipped through Congress, and its approval gives Wickard a strong point to substantiate his claim that REA can do the job—and on terms it doubts that private capital can match.

Three Year Program

Wickard's other reason why REA can do the job of serving every farm home, whether economic or not, is momentarily less imposing than the point just cited. It consists of the effort being made by Sen. Scott Lucas, Illinois Democrat, to pass legislation under which REA would get $5,000,000 a year to plan its "area coverage" program and would be authorized to make commitments for construction valued at $585,000,000 over three post-war years. This program, which has the endorsement of the President, would be in addition to the $100,000,000 worth of REA projects all ready to go when building restrictions are lifted. If $685,000,000 be available, Wickard argues, it should be apparent that REA is financially responsible for the program it suggests.

This, then, is Wickard's appraisal of the place private utilities have in rural electrification and the basis he has for believing that REA can take over the whole business successfully.

It isn't based on the law, as a Cabinet member's program might be expected to be; it does its best to put the government farther into business than ever before, which theoretically isn't the American way of doing things; and it bluntly seeks further strife between business and government, which also, theoretically, is the wrong way.

But Wickard's proposal is so politically sound that it will be difficult to fight. The private company which tries to explain to a group of farmers just why it is uneconomic to build lines to every home in a valley will be distinctly at a loss for a convincing argument when it is pointed out that the REA has the money and doesn't give a hoot whether it's economic or not—it just wants to build the lines.

What to Do About It

The very logical argument available to the company that it cannot afford to do business at a loss, even though it makes sense to a farmer, will be countered with the equally telling argument that what is desired is electric service and why should it be refused from one source just because another source is unable to supply it.

The question then arises of what to do about the Wickard program. It is inconceivable that the companies will choose to quit all rural territory just because a Cabinet member, whose words were parrotted by the President, wants them to do so.

It is equally inconceivable that the industry will choose to buck as politically effective an argument as Wickard has advanced if a better solution can be found.

It begins to look as though the best way, if not the only way, to beat Wickard's attempt to euchre the utilities out of rural business is to put on an "area coverage" program at least as good as that REA can offer.

NEWS OF THE WEEK

Congress Recesses, Stops Action on Power Bills

Pace and Surplus War Property Disposal Bills Passed During Short Session—Leland Olds Approved—Missouri Valley Authority, Public Roads with REA Amendment, and St. Lawrence Bills on Agenda

Congress was in recess this week until Nov. 14, and vastly more concerned with the problem of re-election than with its unfinished business affecting the electric power industry.

When it returns, it will have at most five and one-half weeks of life remaining, a circumstance which will have considerable effect upon what it manages to do before final adjournment. The 79th Congress will open early in January.

In the sparsely attended session just completed—it opened early in August after the presidential conventions—Congress acted on three items of interest to the electric power industry. It confirmed the re-appointment of Leland Olds to the Federal Power Commission over opposition by elements of the natural gas industry and certain state regulatory commissions. It dug out of a conference committee and passed the Pace bill which extends the life of the Rural Electrification Administration, lowers interest rates on REA loans and extends their maturity date 10 years, and eliminates ceilings on appropriation or loan authorizations. The President approved the bill last week.

Congress also passed a bill governing disposition of surplus war property, which, while it favored publicly owned power systems in many respects, was by no means so drastically in favor of public power as was the Senate version of the bill.

As was expected, Congress was too busy with other matters to get at the Rivers and Harbors or Flood Control bills, both of which contain authorization for huge blocks of additional public power. A House Interstate and Foreign Commerce sub-committee headed by Rep. Lyle Boren, Oklahoma Democrat, took no action on bills to repeal wartime, guaranteeing that the industry will not have that problem to wrestle with before December in any event.

Sen. George D. Aiken, Vermont Republican, who has been victim of a runaround all year on his efforts to get the St. Lawrence Seaway and power project approved, admitted as much on the Senate floor last week when he displayed a political advertisement from a New Orleans paper praising Sen. John Overton, Louisiana Democrat, for having holed up the St. Lawrence project in a Commerce sub-committee. Aiken introduced amendments to both the Flood Control and Rivers and Harbors bills which put the St. Lawrence project in each. Thus, he almost guaranteed that neither bill will become law this year, for the St. Lawrence project was left out of each bill as it was introduced in the House on the basis that it was too controversial an item. In addition to fighting over the St. Lawrence project, legislators will have to settle a dispute over the marketing of power generated at projects in the two bills, for the Senate committee inserted in each amendments giving Interior Secretary Harold L. Ickes marketing authority over such power, although the House had specifically rejected this in one of the bills.

Legislation to establish a Missouri Valley Authority along the lines of TVA was introduced by four members, but nothing was done on it, nor is the remaining time apt to be sufficient to finish hearings, let alone maneuver the matter through both Houses.

Probably the major power issue before Congress after it reconvenes, and probably the one most likely to be acted upon, is the move by Senators Scott Lucas, Illinois, and Lister Hill, Alabama, both Democrats and strong administration men, to amend the pending Public Roads bill so as to give REA $5,000,000 yearly to develop "area coverage" plans and authorizing the agency to make commitments for $585,000,000 worth of building in three post-war years. This move has the support of President Roosevelt, who last week joined Agriculture Secretary Claude R. Wickard in warning against allowing private companies to build lines serving less than all farms in a given area.

There is little doubt that the Public Roads bill will be voted upon before final adjournment, and since the Lucas-Hill program is an amendment to the bill, it would have to be voted upon before the bill itself could be passed or rejected. The popularity of rural electrification with members of both parties is such that passage of the Lucas program or one very close to it, both in scope and in funds, is logically to be expected if the matter can be brought to a vote.

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Basil Manly Heads FPC; Olds Now Vice-Chairman

Basil Manly was elected chairman of the Federal Power Commission last week at the commission's first meeting with full membership since the confirmation of Leland Olds. The election was unanimous.

Olds, who was chairman until his appointment expired last June, was elected vice-chairman for the remainder of the year, in keeping with FPC custom which dictates that the vice-chairmanship be rotated annually.

Manly has been acting chairman since Olds' appointment expired after the Senate recessed for the presidential conventions without acting upon the re-nomination. A native of Greenville,

S. C., Manly has been a member of the Commission since 1933, and was vice-chairman from 1933 until 1936, as well as in 1942, 1943 and 1944. He was commissioner-in-charge of the National Power and Electric Rate Surveys of 1933-36, and was named vice-chairman of the National Defense Power Committee. In 1939 he served as chairman of the Committee on Generation and Distribution of the National Association of Railroad and Utilities Commissioners. During the first World War, Manly was joint chairman with former President William Howard Taft of the National War Labor Board.

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Nazi Defeat Will Lighten Control on Copper Wire

Reduced military demands for copper wire and cable after Germany has been defeated will permit both acceptance and delivery of orders other than those authorized under the Controlled Materials Plan, unless anticipated requirements are materially increased, WPB officials told the copper wire and cable industry advisory committee recently.

Industry members recommended that WPB continue both the allocation of refined copper and the directed production and distribution of intermediate shapes until both Germany and Japan have been defeated. This was suggested on the possibility that the supply of copper after the German defeat will be insufficient to meet both military and civilian requirements.

Crude rubber and chemicals required in the production of wire and cable are still scarce and probably will be controlled strictly by WPB even after the defeat of Germany, according to a copper division spokesman who added that removal of all restrictions of deliveries to and from warehouses after German defeat is contemplated.

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County Commissioners May Grant Franchises

The grant of a franchise by county commissioners for the operation of a public utility in an unincorporated town in New Mexico is valid, according to a recent opinion of Assistant Attorney General Robert W. Ward.

He asserted that while there is no statute specifically authorizing county commissioners to grant franchises, there is a general provision vesting in the county power to make contracts and do all other acts necessary to the exercise of its corporate or administrative powers.

OWU Eases Limits on Utility Buildings

Electric utility building construction, formerly governed by Orders L-41, is now governed by Paragraph (i) (5) of Order U-1, the Office of War Utilities pointed out this week concurrently with announcement of an amendment to L-41.

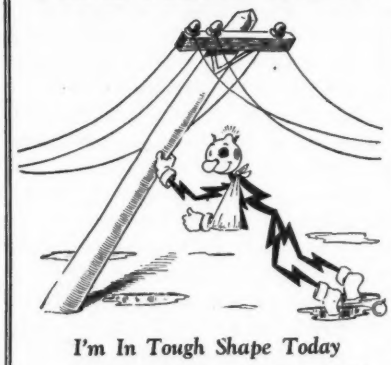
Utilities may now erect buildings without specific authorization provided their cost is less than $10,000 and provided they do not use a material or design forbidden by Schedule A of CMP Regulation 6. If the proposed construction will use such design or material and will cost more than $800, specific approval must be obtained on Form WPB 2774.

OWU has amended U-1-a to include the veterans administration in the list of agencies which may be served without specific authorization. This is in keeping with the recently enacted "G. I. Bill of Rights," which decrees that the veterans administration shall be second only to the armed services in obtaining priority assistance.

Direction 2 to Order U-1 has been amended to remove the limits on controlled materials which may be had for specific jobs and to relieve users of controlled materials from the rigid accounting heretofore required. Hereafter, no specific allotment of controlled materials will be made on an approved 2774 application, but the assignee will be allowed to purchase what is needed to do the job, so long as the job is not enlarged beyond that approved on the 2774 application. Ordering will not have to be done by quarters in stipulated fashion, and no accounting involving the return of excess materials will be required.

The move is expected to do away with considerable paperwork, both by companies and by OWU, and is based upon the fact that controlled materials are now sufficiently available as not to require the same rigid accounting which was necessary earlier.

"I HAD A BAD NIGHT!"



I'm In Tough Shape Today

Trees are down all over the County Our electric lines are down in hundreds of places as a result.

Our Linemen have been on the job without rest ever since the storm began last night. Thru the night they worked—in the wind and rain and with trees falling around them — and they are STILL working to restore service to normal.

Please be patient during this emergency. Everything humanly possible is being done to restore Electric Service.

Rockland Light and Power Co.

THIS TELLS THE STORY—This advertisement of the Rockland Light & Power Co. presents in a humorous vein the difficulties faced by electric utilities in the Eastern Coast hurricane area. Utility companies turned to newspaper ads to keep their customers informed of line conditions, to ask their help, and to thank them for their cooperation

Against Utility Franchises Unless All Farms Served

Private utilities should not be granted franchises for the erection of rural electric lines unless they plan to serve all farms in the area, Secretary of Agriculture Claude R. Wickard recently told a meeting of the Wisconsin Electric Cooperative at Neillsville, Wis.

"No one should be permitted to build lines which will serve only that part of an area which will show a profit, thus making it impossible to serve the rest of the area without a loss," Mr. Wickard said. "If we permit cream-skimming of all good territories, a lot of people are going to be left without the benefits of electricity."

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Water in East Sufficient Despite Light July Rains

Stream flow in Atlantic Coast states north of Virginia averaged only 50 percent of normal during July, the Interior Department's Geological Survey reported this week, but general improvement was noticed in South Central states where the situation was the most serious during July.

Storage reserves in the East were lower than at a corresponding date last year but are reported ample, with no shortages for power generation either in existence or in prospect.

Streamflow in the Pacific Northwest continued deficient but was higher in relation to normal than during July. In a broad region from Kansas to Manitoba, streamflow was well above normal, but in the central inter-mountain region, notably Colorado and Utah, streamflows dropped to sub-normal.

Stresses Engineers' Place in Utility Firm Finance

C. B. McManus, Georgia Power Co., Claims Engineering Advice Important in Maintaining Economic Position of Utility in Paper Before Engineering and Operations Section of Southeastern Electric Exchange

Avoidance of weakening the economic and financial position of the utility is on a par with the task of so conducting the business that the customers and the public will want to continue doing business with the utility rather than someone else said C. B. McManus, assistant operating manager of Georgia Power Co. in a paper last week at the engineering and operations section of the Southeastern Electric Exchange at New Orleans.

Achievement of the former job is more a responsibility of engineers and operating men than many managements appear to realize. Engineering advice should, Mr. McManus said, more often be sought on matters frequently delegated only to public relations, rate, financial or legal staffs. In discussion P. J. Carlin, Florida Power & Light Co., cautioned against system investment economies which would later curtail irreparable costs in operation, maintenance and public disaffection. H. B. Sargent, Mississippi Power & Light Co., the chairman, seconded the assertion that when service quality deteriorates everything goes retrograde.

Encourage Venture Capital

Utility problems will not, as many seem to hope, vanish when the war ends said A. B. Paterson, president of New Orleans Public Service, at a luncheon talk; there will need to be more friendly collaboration between government agencies and industry. He cited WPB as a superb current example and added that the utilities had done more for the war effort at less cost to the government than any industry he knew about. He urged a philosophy of taxation which will make jobs by encouraging venture capital.

Allis-Chalmers has recently quoted to a utility company on a 2,000-kw. gas turbine, according to C. C. Jordan, manager of central station sales, in a paper on the commercial aspects of gas turbine developments. He said his company is ready to build a limited number of experimental units of 1,000 to 5,000 kw. (without maintenance or efficiency guarantees) for inexpensive peak load duty. They offer small buildings, quick pickup and isolated operation at outlying centers; pricing will be comparable to Diesel costs.

Following a paper by A. E. Knowlton, ELECTRICAL WORLD, reporting the national trends in gearing urban and rural systems to the forecasted post-war loads, C. W. Mayott of WPB said the material being released for civilian utilization will result in active production of electrical appliances. Utilities and equipment manufacturers will soon "be on their own" in negotiating the requisite system facilities to meet the consumer demands.

Papers by J. S. Parsons, Westinghouse Electric & Manufacturing Co., and O. B. Falls, General Electric Co., on substation and distribution layouts brought from V. R. Parrack, Virginia Public Service Co., comment that he hoped to find uses for contactors for prompt clearing of distribution faults, and from Mr. McManus the comment that the trend toward more and smaller substations tended to favor bus regulation. W. R. Bullard, Ebasco Services, reminded that 11 kv. in Dallas had made substations progressively unnecessary. R. O. Loomis, Georgia Power Co., believes in putting the capacity at the load and delivering as much as possible at the highest practicable voltage.

Breaker Problems Explained

Effective coordination of breakers and fuses was detailed by W. R. Doar, Carolina Power & Light Co., and seconded by Mr. Bullard, as a means of bringing radial reliability to parity with more expensive schemes of distribution. Extensive breaker modernization, installation of counterpoise and reclosure on Alabama Power's 110-kv. lines has greatly improved line outages and burndowns according to W. I. Woodcock. Mr. McManus said counterpoise had also been well worthwhile in Georgia. Miles Cary, Virginia Electric & Power Co., reported practical elimination of outages after putting tubes on every fifth (guyed) structure on a troublesome 35-mile H-frame line without ground wires.

W. C. Feaster said the 80-kc. carrier system of Potomac Edison Co. (ELECTRICAL WORLD, November 14, 1942) has performed at least 80 percent of the time at not more than half the outlay for the message-limited space radio system for reaching mobile units. J. L. White, Appalachian Electric Power Co., hoped that restrictions on the use of F.M. can reasonably be relaxed.

There was a suggestion that one manufacturer is actively contemplating a plastic form of street-light fixture.

In discussing wartime experience in operating Alabama Power's fleet of trucks and cars, W. P. Postell said there would not be much point in making new system equipments available to utilities unless there is corresponding opportunity to get trucks and tires to haul the equipment to the job.

Attendance was 175 at sessions which also saw discussion of modernized street lighting by Chase Hutchinson, Ebasco Services, load control and telemetering on the Southwest Power Pool by E. E. George, fire fighting principles by D. L. Cannon, Carolina Power & Light Co., and synthetic insulations by R. J. Wiseman, chief engineer of Okonite.

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Michigan May Order More "Profits" Rebates

Michigan Public Service Commission has before it for study reports from three electric utility companies to determine whether any should be ordered to rebate so-called "excess profits" to their customers.

The reports were requested after the commission had instructed the Detroit Edison Co. to rebate $10,450,000 to customers in southeastern Michigan to avoid payment of federal excess profits taxes this year.

Gilbert T. Shilson, commission chairman, said the commission would analyze the reports and then it might suggest to some of the utilities that they voluntarily rebate part or all of the excess profits tax reserve. Those companies, he said, which refuse to make a voluntary rebate, probably will be ordered to do so formally.

The utilities, reporting $5,094,671 in anticipated excess profits taxes, included Consumers Power Co., $5,023,471; Wisconsin-Michigan Power Co., $58,200; Menominee and Marinette Light & Traction Co., $13,000.

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President Asks for MVA

President Roosevelt asked the creation of a Missouri Valley Authority last week in a message to Congress conveying a resolution adopted by governors of the nine affected states, who seek an "overall, comprehensive plan" for development of the river.

The President also pointed out that he has, in the past, similarly recom-

mended creation of an Arkansas Valley Authority and a Columbia Valley Authority, and asked that renewed consideration be given these projects as well as the Missouri Valley project.

Citing accomplishments of the TVA, the President suggested that it serve as a pattern for other regional authorities and stressed that control over appropriations would give the federal government jurisdiction over the entire project.

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Co-op Denies Being Public Utility Subject to D.P.U.

The Ark-La holding company cooperative denied that it is a public utility and subject to jurisdiction of the Arkansas Department of Public Utilities in a brief filed with the D.P.U. on September 18 in proceedings brought by four business-managed electric companies, Arkansas Power & Light Co., Southwestern Gas & Electric Co., Oklahoma Gas & Electric Co., and Arkansas-Missouri Power Corp.

Ark-La, financed by REA, was formed by five Arkansas and five Louisiana rural co-ops to serve power to the Jones Mills Aluminum plant at Lake Catherine, Ark. The aluminum plant is its own customer and at a hearing several months ago Ark-La's president admitted that the Defense Plant Corporation, which operates the aluminum mill, was taken into membership of Ark-La only after the present proceedings had been started.

In its brief, Ark-La contends it is exempt by statute from jurisdiction of the Arkansas D.P.U., although it is a Louisiana corporation. The electric companies contend it was not organized under the Arkansas rural co-op law of 1935.

Ark-La further contends that it is not subject to D.P.U. regulation because it is engaged entirely in interstate commerce, and it further contends that the claim of the electric companies that it is not operating as a non-profit cooperative is "purely a legal question" which only the courts can decide.

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Offers Motor Information

Information regarding the acquisition of standard, rebuilt fractional horsepower motors may be obtained by repair shops which need such motors from W. T. Wessels, used motor section, War Production Board, Temporary "E" Building, Washington 25, D. C., WPB announced this week. Reports on used motor sales and deliveries, and records of availability of used motors are kept in that office.

Ohio Electric Utility Accountants Organize

Formed to cooperate with the Public Utilities Commission of Ohio in the study and solution of electric utility accounting problems, the Electric Utility Accountants of Ohio has drawn up a constitution and by-laws.

Heading the new group is M. W. Thernes, vice-president and secretary-treasurer, Ohio Public Service Co., Cleveland, who believes the association's

M. W. Thernes

purpose and objectives to be unique in public utility accounting history. He credits George C. McConnaughey, chairman of the commission, with the idea of forming the association.

As objectives of the association, these are among those in the by-laws:

"To act as a central agency through which will clear information relating to electric utility acounting matters affecting privately owned electric utilities in Ohio."

"To cooperate with the Public Utilities Commission of Ohio in formulating accounting standards and principles to be used by electric utilities in the state."

"To consider and recommend additions to, or changes in, utility accounting standards and principles."

The executive committee of the association includes: W. H. Zimmer, treasurer and assistant secretary, Cincinnati Gas & Electric Co.; T. Stiverson, treasurer and assistant secretary, Columbus & Southern Ohio Electric Co.; H. T. Ledbetter, secretary, Toledo Edison Co.; R. H. Smith, controller, Cleveland Electric Illuminating Co.; H. Armstrong, assistant secretary, Ohio Power Co., Newark; J. W. Perry, vice-president, Central Ohio Light & Power Co., Findlay; B. C. Taylor, vice-president and treasurer, Dayton Power & Light Co.; and F. Murdock, general auditor, Ohio Edison Co., Akron. Mr. Stiverson was named secretary.

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FPC Halts Rate Rise of Connecticut Power

Despite the fact that the Public Utilities Commission of Connecticut had already approved a rate increase for electrical energy sold by the Connecticut Power Co. to the Torrington Electric Light Co. and that the increase is satisfactory to both companies, the Federal Power Commission has ordered the Connecticut Power to suspend the increase until Feb. 3 and to appear at a hearing on Dec. 5 in Washington to prove the new rates are just and reasonable.

The issue is further complicated by the fact that all of the power involved is generated within the state, is carried over lines solely in the state, and is consumed within the state. Therefore, in the opinion of Connecticut Power, its sales to Torrington Electric are not sales at wholesale in interstate commerce, and there is serious question as to whether or not the Federal Power Commission has jurisdiction over these rates.

To supply Torrington Electric and its own customers in the Farmington River Valley, Connecticut Power buys its requirements from Hartford Electric Light Co. Since the last rate adjustment in January, 1941, the cost of fuel has gone up about 40 percent, and the Hartford company charges to Connecticut Power have reflected this increase. About $80,000 of the estimated increase in cost to the Torrington Electric for the year ending June 30, 1946, is due to this actual increased fuel cost. The balance of $24,000 is due to added facilities and capacity required to serve Torrington.

The FPC said the new rate may result in an "undue burden" upon retail consumers in Torrington who buy energy from the Torrington company.

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Wage Increase Approved

A 4-cent-an-hour raise has been granted Louisville Gas & Electric Co. employees by the War Labor Board after a joint appeal by the company and the Independent Protective Association of Utility Workers. Since the raise is retroactive to October 31, 1943, the company will begin payment of $100,000 back pay.

Great Opportunities Ahead Indiana Utility Men Told

Walker, Council of Electric Operating Companies Head, Praises War Record of Power Companies—Purdue Dean Shows Relationship Between Wages and Power at Disposal of Worker

Conviction that great opportunities for progress and public service face a utility industry that is alert, progressive and self confident, marked the expressions of national speakers at the annual meeting of the Indiana Electric Association at French Lick last week. Some 500 utility men from Indiana and nearby states gathered for a three-day conference dedicated to the analysis of peacetime prospects of the electrical industry.

Presenting his personal view of utility prospects in peacetime, Tom P. Walker, president of the Council of Electric Operating Companies, expressed pride that the utilities are about to emerge from war with a record that no other industry can match. "We have met our responsibilities," Mr. Walker stated. "We are lean and efficient; our prices are down, and we stand at the threshold of great opportunities for public service."

Concerning postwar responsibilities of the utilities to themselves and to the public, Mr. Walker continued: "The opportunities of this industry lie first in returning to our former high position of personalized service and secondly in seeking out unifying elements in the industry, forging them into a single program founded sincerely on long-time public interest and giving that program complete support on a national scale."

"Hard work, initiative and ingenuity have been the American way of satisfying material needs," Dean A. A. Potter of Purdue University told the conference. "Our entire future depends on our remaining a creative people." Discussing the relationship between electric power, national productivity and wages Dean Potter pointed out that there is a direct relation between the wages of an industrial worker and the power he has at his disposal to increase his productivity.

Dean Mitchell, president of Northern Indiana Public Service Co. in a vigorous defense of the capitalistic system, which he characterized as the foundation of the "American Way," warned that this system faces a critical challenge in the problems of distribution and unemployment, after the war. Given solutions to these, he felt that industry would enter the greatest era of production and expansion that the country has ever known.

Conviction that the differences between rural electric cooperatives and the utility industry in Indiana, and possibly elsewhere, are not basic and fundamental but merely technicalities which can be ironed out, was expressed by Hassil E. Schenck, president, Indiana Farm Bureau, who called upon the two groups to arbitrate their differences and difficulties after the war and move ahead together.

C. W. Kellogg, president of the Edison Electric Institute, cautioned electric utilities to protest any attempts to lower rates during wartime. Increased profits at present are a temporary phenomenon and will disappear with the end of war. Any permanent rate reduction now based on war profits will be unfair and will work a hardship," he stated.

L. B. Schiesz, vice-president of Public Service Co. of Indiana, speaking as chairman of the wartime committee for the coordination of power supply for the Indiana area, traced development of the interconnected power system in the state as it has been expanded since 1940 to meet demands of war. In the four year interval Mr. Schiesz showed that peak load, increasing from 1,200,000 to 1,925,000 kw. had been met by boosting generating capabilities from 1,535,000 to 2,140,000 kw., cutting reserves from 22 to 10 percent, building 1,300 miles of transmission line and in general developing the potentialities of utilities in Indiana and neighboring areas. "We do not anticipate any substantial loss of load after the war," he said. "Loss of large power loads will simply restore our former margins of

PROMINENT AT INDIANA ELECTRIC ASSOCIATION MEETING—LEFT: F. B. Culley, vice-president, Southern Indiana Gas & Electric Co.; R. A. Gallagher, president, Public Service Co. of Indiana; and H. T. Pritchard, president, Indianapolis Power & Light Co. RIGHT: Tom P. Walker, president of the Council of Electric Operating Companies; C. W. Kellogg, president, Edison Electric Institute; and Dean Mitchell, president, Northern Indiana Public Service Co. and retiring president of the association

reserve capacity," Mr. Schiesz stated.

Functionally, public information and public relations are synonymous J. W. McAfee, president of Union Electric Co. of Missouri told the conference. He recommended that utilities give their customers information on what they are paying for and why. "It is information that the public wants, and a guide to the way to use it," Mr. McAfee stated. Utility executives will also find it

NEW PRESIDENT—L. B. Schiesz, vice-president, Public Service Co. of Indiana, newly elected president of the Indiana Electric Association, confers with Marshall Dale, president, Indiana Service Corp.

profitable, he felt, to re-examine company practices that involve direct personal contact with customers. He recommended that public information be geared to public interests and not to the interests of utility management.

A goal of double the average residential usage of electricity in the first five years after war, the relighting of all commercial and factory buildings in ten years and the extension of rural lines to all serviceable farms within five years, was suggested to the utility industry by S. B. Williams, editor of ELECTRICAL WORLD. While estimating that the cost of winning these goals would be large, Mr. Williams said utility management should not be frightened. "Objectives of this order will bring a stronger financial position to the utilities and a greater security of corporate identity," he affirmed.

Representing the electrical manufacturers among the conference speakers were: H. V. Erben, General Electric, who called upon the utilities to join with the manufacturing industry in bringing about equipment standardization and R. A. Neal, Westinghouse, who pictured the re-awakening need for selling and sales training that exists in all branches of the electrical industry.

Widely commented upon in conference corridors was the suggestion of banquet speaker, Dr. George S. Benson, president of Harding College, that it is the responsibility of business men to carry the story of private enterprise to high school students and young people to combat socialistic influences.

Officers of the Indiana Electric Association for the coming year are: President, L. B. Schiesz, vice-president, Public Service Company of Indiana, Inc.; vice-president, Arnold Hogan, Indiana Service Corp.; secretary-treasurer, E. F. Hauser.

Want Road Across Dam to End Traffic Bottleneck

Contending that the lake formed by the Kentucky Dam of the Tennessee Valley Authority at Gilbertsville, Ky., will create a traffic bottleneck, traffic and highway authorities have started a campaign for a highway across the top of the dam. They point out that the dam will create a reservoir 184 miles up the Tennessee River representing the largest man-made lake in the country.

Kentucky Highway Commissioner J. S. Watkins said the Federal Government is willing to pay about 60 percent of the roadway cost if approved by state highway officials; he, however, has refused to approve the project because he feels that since the dam is federally owned, the roadway should be paid for by the federal government.

Annual $700,000 Post-war Wiring Expenditure Seen

A prediction that in the post-war period there will be annual expenditures of $700,000 for wiring for each 100,000 population or for each 25,000 homes was made by R. B. Kellogg of the Commonwealth Edison Co., Chicago, in a speech at the fortieth annual meeting and war-time conference of the Western Section, International Association of Electrical Inspectors, this month, at Indianapolis. There was general agreement that most American homes are inadequately wired for the post-war electronics area.

To protect home-owners against fire loss through faulty wiring, the section advocated that before any property could be transferred it be inspected and the wiring approved before the sale could be completed.

Roy Burgess, Chicago, was elected president; G. C. Monroe, Springfield, Mo., first vice-president; and A. H. Welkin, Fort Wayne, Ind., second vice-president. F. H. Moore, Indianapolis, was reelected to the position of secretary-treasurer.

MEETINGS

Joint Fuels Conference—American Institute of Mining Engineers and American Society of Mechanical Engineers—Daniel Boone Hotel, Charleston, W. Va., October 30-31. A. B. Parsons, secretary, American Institute of Mining Engineers, 29 W. 39th St., New York 18, N. Y.

Pacific Coast Electrical Association—Annual fall conferences, northern section, Fairmont Hotel, San Francisco, Calif., November 9; southern section, Hollywood Roosevelt Hotel, Hollywood, Calif., November 16. V. W. Hartley, managing director, 601 W. 5th St., Los Angeles, Calif.

National Exposition of Power and Mechanical Engineering — Madison Square Garden, New York, N. Y., November 27-December 2.

Previously Listed

National Electrical Contractors Association—Annual meeting, French Lick Springs Hotel, French Lick, Ind., October 1-5. L. W. Davis, general manager, 633 Investment Bldg., 15th and K Sts., N.W., Washington, D. C.

Edison Electric Institute—Prime movers committee, Wm. Penn Hotel, Pittsburgh, Pa., October 2-3; electrical equipment committee, Schenley Hotel, Pittsburgh, Pa., October 5-6; transmission and distribution committee, Hotel Statler, Buffalo, N. Y., October 9-10. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

International Municipal Signal Association—Annual meeting, Hotel Statler, Boston, Mass., October 2-5. Irvin Shulsinger, secretary, 8 E. 41st St., New York 17, N. Y.

National Safety Council—Annual congress, Sherman, Morrison and LaSalle Hotels, Chicago, Ill., October 3-5. N. H. Dearborn, managing director, 20 N. Wacker Drive, Chicago, Ill.

National Electronics Conference—Medinah Club, of Chicago, 505 N. Michigan Ave., Chicago, Ill., October 5-7. Beverly Dudley, secretary, 520 N. Michigan Ave., Chicago 11, Ill.

Kansas Association of Municipal Utilities—Annual convention, Broadview Hotel, Emporia, Kansas, October 8-10. Grace L. Crosman, asst. secretary, McPherson, Kansas.

Electrochemical Society—Fall meeting, Hotel Statler, Buffalo, N. Y., October 12-14. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York, N. Y.

American Welding Society—Annual meeting, Hotel Cleveland, Cleveland, Ohio, October 16-19. Miss M. M. Kelly, secretary, 29 West 39th St., New York 18, N. Y.

Pennsylvania Electric Association—Electrical equipment committee, Johnstown, Pa., October 19-20; A. N. Shealy, chairman, Pennsylvania Water & Power Co., Lexington Bldg., Baltimore, Md. Systems operation committee, Roosevelt Hotel, Pittsburgh, Pa., October 26-27; A. R. Deck, chairman, Metropolitan Edison Co., Reading, Pa.

Electronic Parts and Equipment Industry Conference — Hotel Stevens, Chicago, Ill., October 19-21. Chas. Golenpaul, publicity chairman, c/o Aerovox Corp., New Bedford, Mass.

Engineers Council for Professional Development—Annual meeting, Engineering Societies Bldg., New York, N. Y., October 20. S. L. Tyler, secretary, 29 W. 39th St., New York 18, N. Y.

National Electrical Manufacturers Association—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., October 23-27. W. J. Donald, managing director, 155 E. 44th St., New York 17, N. Y.

Southeastern Electric Exchange—Sales conference, Henry Grady Hotel, Atlanta, Ga., November 9-10. J. W. Talley, executive secretary, 302 Haas-Howell Bldg., Atlanta 3, Ga.

National Association of Railroad and Utilities Commissioners—Annual meeting, Hotel Fontenelle, Omaha, Neb., November 14-17. Ben Smart, secretary, 7411 New Post Office Bldg., Washington 25, D. C.

Great Lakes Power Club — Fall meeting, Palmer House, Chicago, Ill., November 17. Adolph Schlessinger, Public Service Co. of Indiana, Traction Terminal Bldg., Indianapolis, Ind.

American Society of Mechanical Engineers—Annual meeting, Hotel Pennsylvania, New York, N. Y., November 27-30. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

Energy Output Curve Moves Downward

The output curve moved downward during the week ended September 23, 1944, according to figures released by the Edison Electric Institute. Electrical energy distributed by the light and power industry during the week amounted to 4,377,339,000 kw.-hr., as compared with 4,394,839,000 kw.-hr. for the preceding week ended September 16. Figures for the week represented an increase of 0.4 percent over the 4,359,610,000 kw.-hr. distributed during the corresponding week a year ago. The output for the similar week in 1942 was 3,720,254,000 kw.-hr.

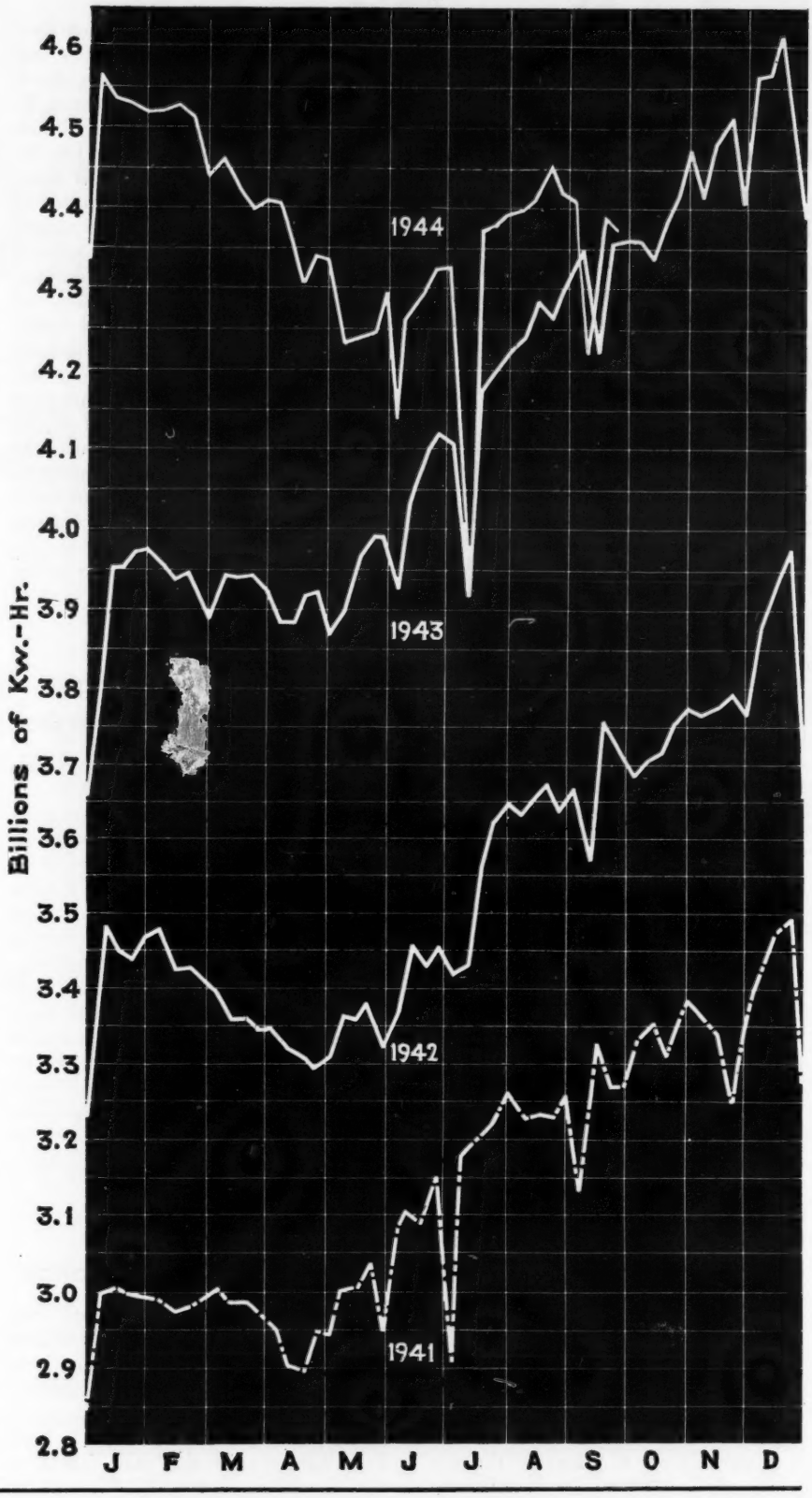
Four of the seven major geographic regions of the country reported increases over the corresponding week in 1943. The Pacific Coast states, which for so long have reported the highest percent gain, showed a loss of 1.9 percent for the week ended September 23 as compared with the corresponding week last year. The West Central states reported the largest increase—6.4 percent—and the Southern States ran a close second with a gain of 5.9 percent. The New England group returned to the plus column during the week ended September 23, with a gain of 0.6 percent.

Weekly Output Millions Kw.-Hr.

1944		1943		1942	
Sept. 23	4,377	Sept. 25	4,360	Sept. 26	3,720
Sept. 16	4,395	Sept. 18	4,359	Sept. 19	3,757
Sept. 9	4,228	Sept. 11	4,229	Sept. 12	3,583
Sept. 2	4,415	Sept. 4	4,351	Sept. 5	3,673
Aug. 26	4,418	Aug. 28	4,322	Aug. 29	3,640
Aug. 19	4,451	Aug. 21	4,265	Aug. 22	3,674
Aug. 12	4,415	Aug. 14	4,288	Aug. 15	3,655
Aug. 5	4,399	Aug. 7	4,241	Aug. 8	3,637
July 29	4,391	July 31	4,227	Aug. 1	3,649
July 22	4,381	July 24	4,196	July 25	3,656
July 15	4,377	July 17	4,181	July 18	3,566
July 8	3,941	July 10	3,919	July 11	3,429

Percent Change from Previous Year

	Week Ending		
	Sept. 23	Sept. 16	Sept. 9
New England	+ 0.6	— 1.6	+ 2.0
Mid Atlantic	— 4.0	— 2.1	— 6.2
Central Industrial	+ 2.2	+ 2.0	+ 0.1
West Central	+ 6.4	+ 2.1	+ 1.4
Southern States	+ 5.9	+ 3.4	+ 4.3
Rocky Mountain	— 9.6	— 6.9	— 5.8
Pacific Coast	— 1.9	+ 4.0	+ 4.6
Total United States	+ 0.4	+ 0.8	+ 0.0



Southern California To Get Additional Boulder Power

Further power for southern California from Boulder Dam will be released with the shutting down of production at Basic Magnesium, Inc., world's largest magnesium plant which is operated by Anaconda Copper Mining Co., for Defense Plant Corporation, Las Vegas, Nev.

Already released in cutbacks which have reduced operations at Basic Magnesium 60 percent are about 400,000,000 kw.-hrs. on an annual delivery basis. The final cutback, expected to be complete by December, will augment southern California's power resources to the extent of 900,000,000 kw.-hrs.

Co-op Buys Oregon Co.

All electric property of the Oregon Gas & Electric Co. in the Oregon counties of Clatsop, Columbia, and Washington has been sold to West Oregon Cooperative, Inc. The $130,000 purchase was financed by the Rural Electrification Administration.

Prosperous Post-war Market Predicted

I.A.E.L. at Annual Meeting Learn of Appliance Selling Problems

A prosperous post-war world in which appliance sales will be double those of pre-war days, in which salesmen must be highly trained to promote and sell new products, and in which financing of appliance sales and complete electrically equipped homes will furnish problems difficult of solution was described by speakers at the ninth annual conference of the International Association of Electrical Leagues last week at Detroit.

High postwar sales of appliances were predicted by a number of speakers. J. S. Bartlett, managing director of the Electric Institute of Washington, said that retailers and wholesalers must act now to gear themselves to handle about double their previous high appliance sales volume. M. R. Rodger, customer service and sales manager, Middle West Service Co., Chicago, predicted a peak sale of appliances, in 194X of $2,500,000,000.

Discussing the future of lighting in the commercial and industrial markets, J. L. Kilpatrick, illuminating engineer, Lamp Division, Westinghouse Electric & Manufacturing Co., predicted a $1,500,000,000 lighting business in 1948 and a doubling of the lighting equipment and lamp market in the next ten years.

Rewiring Will Be Important

Reviewing the opportunities for electrical modernization and equipping in the commercial market, William T. Stuart, editor, *Electrical Contracting*, predicted a total of $1,768,000,000 for commercial construction annually for five post-war years. The electrical share of this construction dollar will be substantially larger in percentage than in pre-war years, he revealed, adding that electrical materials alone, exclusive of lighting fixtures, will approximate $125,000,000 annually. A large factor in the post-war commercial market potential will be modernization, tenant changes, and rewiring of existing buildings.

A warning not to glamorize the electrical appliance business as the ideal enterprise for returning servicemen was extended by President W. A. Ritt. He said new salesmen and appliance dealers must be highly trained to promote, sell, and service the new products the public will demand; he pointed out that there is dire need for farm electrical equipment dealers.

League delegates were given an insight into the practical problems the builder faces in providing complete electrically equipped homes at a price that 80 percent of the population can afford. Discussing some of these problems, W. J. Guinan, executive director, Builders' Association of Metropolitan Detroit, stated that adequate wiring and maximum amount of electrical equipment cannot be furnished in a house costing less than $6,000 and that FHA mortgages must be extended up to perhaps 40 years to lower monthly payments so that the $2,500 per year and under group can enjoy these living comforts.

To reach this same low income group, Richard M. Jones, western manager, Architectural Forum, presented a plan for financing refrigerators, ranges, and other appliances under the long term amortized home mortgage. By adding a few dollars per month to the payments on a home to cover this equipment, this plan will permit the home owner to buy more electrical appliances.

o

Renegotiation Meetings Will Begin in September

The first series of meetings with electric companies assigned the War Department for statutory renegotiation will be held during the last week of September and the first week of October, when as many as eighteen companies all over the country will meet with officers of the various Army Service Commands for preliminary conferences.

A War Department spokesman said the conferences will be held with those companies whose cases, for one reason or another, are most nearly ready for action. In some cases, he said, it may develop that there is no renegotiable business, and the way would then be cleared for issuance of final clearances to these companies.

o

Utility Coal Consumption

Electric utility power plants consumed 7,365,564 tons of coal in August, 1944, the Federal Power Commission has reported. The commission also reported that the coal stocks of electric utility power plants as of Sept. 1, 1944, were 8.0 percent less than stocks of the same date last year.

UTILITY REPORTS

	1944	1943
*Detroit Edison and subs...	$8,687,577	$8,501,750
†San Diego Gas & Electric..	1,526,246	1,560,740
*Sioux City Gas & Electric..	634,915	721,319
*Tampa Electric	1,218,573	1,186,183

*Twelve months ended August 31.
†Twelve months ended July 31.

Asks Study of Substitutes to Find Permanent Value

Study of substitute materials used during the war period to determine their permanent value to the electrical industry was advocated by Martin F. Cody, chairman of the Post-war Redevelopment Committee of the International Association of Electrical Inspectors, before the Eastern Section of the association last week at Albany, N. Y.

Throughout the entire meeting, speakers expressed the thought that many substitutes and makeshifts made necessary by the war will have to be eliminated for purposes of safety. Various code changes were proposed with this in view.

Adequate wiring was stressed as being necessary both for safety and for convenience. It was pointed out that most homes will not be able to make use of post-war electric appliances until they have been either rewired or have extra circuits added.

Several speakers called for a close inspection of work done during the war, and J. D. Lynett, New York City, chairman of the Fire and Accidents Committee, attributed many of the 2,221 electrically caused fires in New York City in 1943 and of the 2,065 up to August 5, 1944, to untrained industrial "electricians" working on private jobs outside their place of employment.

Officers elected are G. S. Casterline, Syracuse, president; P. J. Hicks, Jr., Providence, R. I., first vice-president; E. T. Quinn, Newark, N. J., second vice-president; A. W. Hopkins, Springfield, Mass., treasurer; F. N. Squires, New York, secretary; M. M. Brandon, New York, W. J. Canada, Mountain Lakes, N. J., C. A. Berlepsch, New Haven, Conn., executive committee; B. A. McDonald, Rochester, R. B. Shepard, New York, G. H. Schardien, Elizabeth, N. J., representatives for three years on executive council, I.A.E.I., and J. W. Hager, New York, for one year.

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Permits Scranton Utility to Cut Original Cost

An arrangement under which the Scranton (Pa.) Electric Co., will immediately reduce by $6,357,561 its book estimate of the original cost of its electric properties has been approved by the Federal Power Commission.

FPC states the actual original cost is $25,082,418, and that the $6,357,561 which is being taken out of the electric plant accounts represents "write-ups", inter-company profit on engineering and supervision fees, and other excess over original cost.

$12,000 failure in a $12 breaker

Could it just as well have been one of yours?

A motor-circuit fault occurred in a busy war-production plant, and the undersized circuit breaker went up in a burst of blue flame. Then, in an instant, the inadequate main circuit breakers failed as well—with a further dangerous blow-up that sent hot metal flying. Not until the power company's breaker tripped out was the short-circuit current brought to a halt. Production of the entire plant was crippled until repairs could be made. The loss exceeded $12,000.

A failure like this—with its threat to production and danger to personnel—strikes more frequently than you think. It could occur tomorrow morning in hundreds of plants where electric circuits are being called upon to handle increased loads that they were never designed to carry. In such "shoestring" power distribution systems, fuses and breakers often lack the capacity to interrupt the full rush of short-circuit current that can flow from the present source.

***One* new circuit breaker is no remedy. The interrupting capacity of *every* protective device, from entrance cable to machine, must be brought into line.**

GENERAL ELECTRIC

TO BE SURE **of adequate interrupting capacity all through the plant, start making plans now to convert to a G-E load-center distribution system.**

HOW A LOAD-

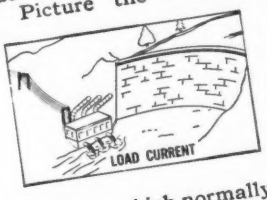
keeps short-circuit

NEED FOR ADEQUATE IC* OFTEN OVERLOOKED

CAPACITY OF SUPPLY SOURCE "TAKES OVER" WHEN SHORT CIRCUIT OCCURS

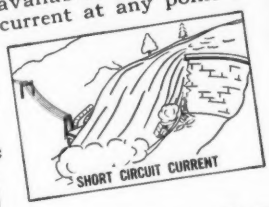
When a short circuit occurs, the flow of current is not limited by the size of the load—it may increase to several hundred times the load current. Thus the load *carrying* capacity of breakers or fuses is no measure of their adequacy as protective devices.

Picture the collapse of a dam which normally supplies a penstock. The resultant damage is limited, not by the capacity of the penstock, but by the head and capacity of the reservoir. So it is with circuit-breaking equipment. Like the rush of water down the valley, too, the damage may be cumulative, so that normally adequate structures below are breached and broken one by one. Failure of an inadequate circuit-interrupting device may cause a new, more serious short within the device itself as parts are welded under the intense heat.



CALCULATING SHORT-CIRCUIT CURRENT

Accurate methods now exist for calculating the available short-circuit current at any point in a power system. These are applied *in advance* in specifying the coordinated elements that go together to make up a G-E load-center distribution system. A G-E application engineer can make sure that any special conditions within your plant are taken into account.



LOAD GROWTH A FACTOR

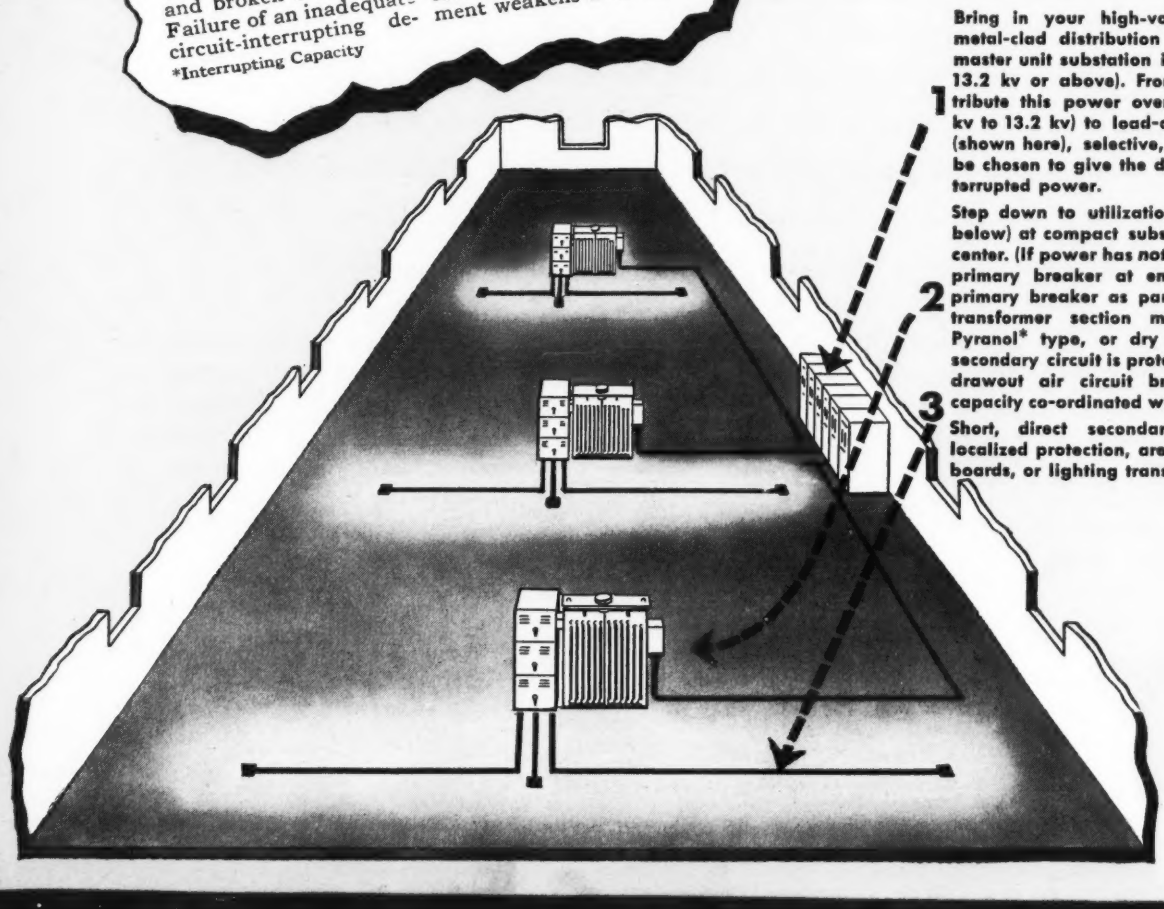
Systems which have been operating for years without a major short circuit often become increasingly vulnerable as load growth raises the capacity of the supply source, and as equipment weakens with age.

*Interrupting Capacity

G-E LOAD-CENTER power distribution affords protection from the dangerous, production-crippling "blow ups" that can result from devices of inadequate interrupting capacity. What's more, the circuit protection for each load area *stays* adequate, despite expansion of your electric system to serve new areas—provided, of course, the system was properly planned originally. Each load-center substation is an individual "road-block" which isolates such short circuits as may occur. Additions to the co-ordinated system can be made without concern as to the interrupting capacity of devices in the localized secondary circuits (where transformers are not in parallel on the secondary side).

War plants equipped with load-center systems have established exceptional records for *uninterrupted* power usage. Now, they are finding that the flexibility of their systems to meet plant changeovers is an equally great advantage.

Before you install any new switchgear, or attempt to revamp outmoded power distribution circuits, switchboards, or substations—better investigate the performance records of G-E load-center installations. Just ask your local G-E representative.



1 Bring in your high-voltage power through a metal-clad distribution and metering panel (or master unit substation if power is purchased at 13.2 kv or above). From primary breakers, distribute this power over high-voltage lines (2.3 kv to 13.2 kv) to load-center substations. Radial (shown here), selective, or network systems can be chosen to give the desired assurance of uninterrupted power.

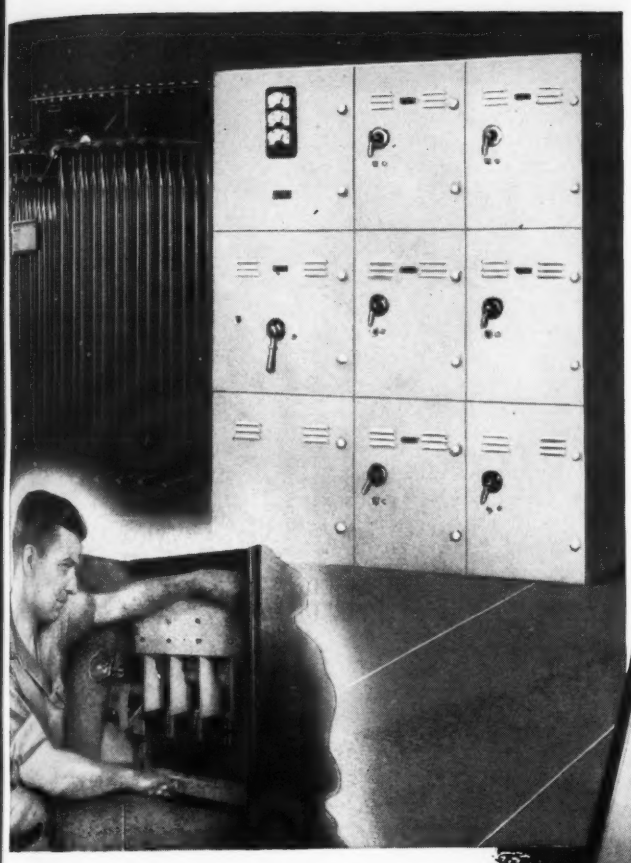
2 Step down to utilization voltage (600 volts or below) at compact substations right at the load center. (If power has *not* come through metal-clad primary breaker at entrance panel, include a primary breaker as part of the substation.) The transformer section may be noninflammable Pyranol* type, or dry type if preferred. Each secondary circuit is protected by a metal-enclosed drawout air circuit breaker, with interrupting capacity co-ordinated with the transformer rating.

3 Short, direct secondary feeders, each with localized protection, are run to equipment, panel boards, or lighting transformers.

*Reg. U.S. Pat. Off.

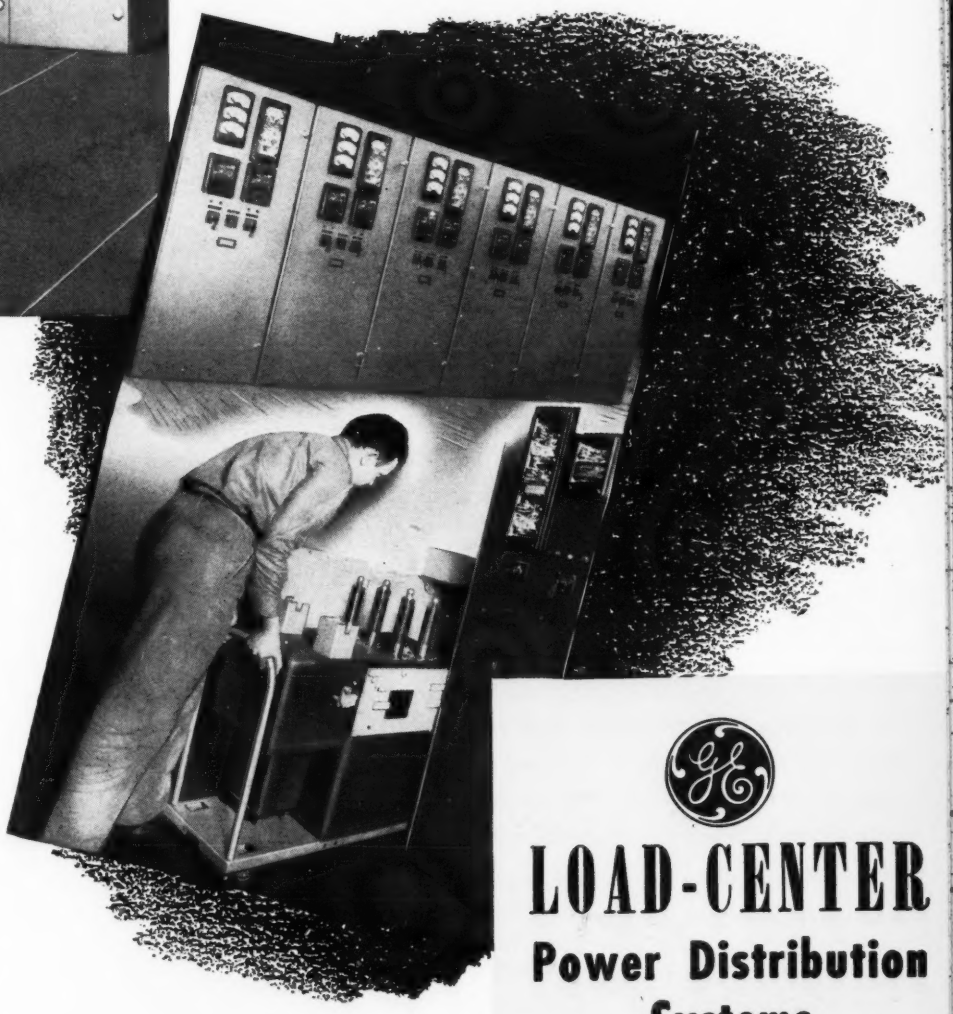
CENTER POWER SYSTEM

currents from *RUNNING WILD*



Key points in load-center power protection are the G-E air circuit breakers, which localize faults in the low-voltage feeder circuits. Their interrupting capacities are *always* matched to the capacity of the transformer.

The draw-out feature simplifies inspection. Interchangeability of breakers cuts circuit-outage time for servicing. Safety interlocks automatically open the breaker upon any attempt to insert or withdraw the breaker while it is in the closed position.



Short-circuit protection of primary plant circuits is best assured by metal-clad switchgear, with magne-blast air circuit breakers, located at the load-center substation, at a central distributing point, or as part of a master unit substation.

Breakers, buses, and other circuit components are completely enclosed within grounded steel compartments that go together to form fully co-ordinated, factory-assembled units. The breakers are of the easily removable and interchangeable type.

Expansion of your power requirements can be handled by adding units electrically matched to the original installation.

LOAD-CENTER

Power Distribution Systems

Buy all the BONDS you can—and *keep all you buy*

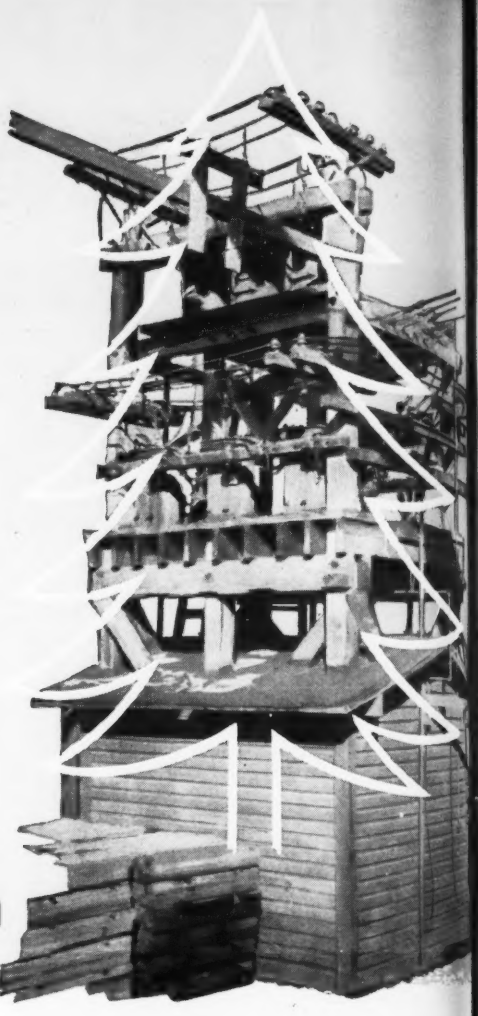
GENERAL ELECTRIC

302-32-5900

Packaged Successor

to

Christmas-tree Design



● G-E UNIT SUBSTATION DOUBLES CAPACIT AT LESS THAN REVAMPING COST

When this lumber mill's load increased, the management first considered revamping a piecemeal-built, wooden-tower substation to double its capacity. This meant making room for three 100-kva single-phase transformers and the necessary accessories, although the old substation impeded yard traffic as it was.

A G-E application engineer reviewed the plans. He showed that a new, factory-built unit substation of 300 kva could be installed for less than the revamping cost. Using a Pyranol transformer section it could be installed indoors, with shorter low-voltage feeders, and greater assurance of uninterrupted service. It meant adequate interrupting capacity, and adequate provision for load growth.

Latest report: "Company is enthusiastic about unit substations and intends to install more."

For complete information on G-E unit substations, see our local representative, or write for Bulletin GEA-3758. General Electric Company, Schenectady 5, N. Y.

UNIT SUBSTATION

✓ —Safely at home anywhere in the plant, thanks to Pyranol or dry-type transformer.

✓ —Interrupting capacity coordinated with transformer rating. Fully metal-enclosed switchgear.

✓ —Built to standard designs by repetitive manufacture. Easy to install and maintain.

GENERAL ELECTRIC

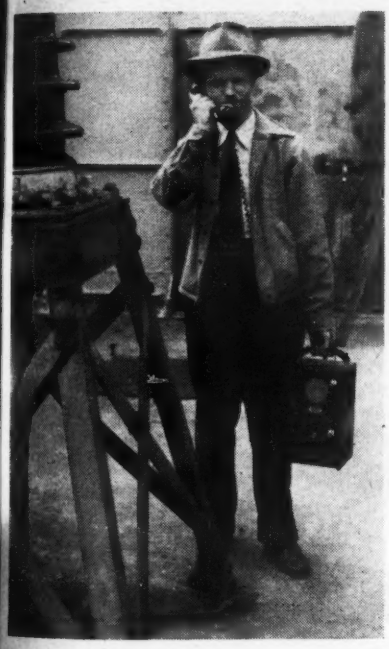
HOW

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

"Walkie-Talkie" Proves Utility Value

W. L. CAMPBELL,*
Northwestern Electric Co., Portland, Ore.

Possibilities of the "walkie-talkie" in power company communications have been apparent to operating men for some time, but no equipment of this kind has been available for civilian use and there has been no opportunity to try out such devices. The need for something of this kind by Northwestern Electric Co. became so acute, however, that the author had the temerity to undertake building two sets, despite inavailability of certain tubes and parts.

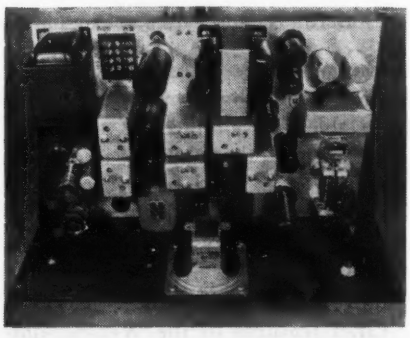


DREDGING OPERATIONS are directed from shore near pothead of 115-kv. submarine cable with ½-watt walkie-talkie. This set with its companion 6½-watt transmitter-receiver are used for shore-to-shore and shore-to-dredge communication. They are licensed by FCC as station "KAGX"

*Communications Engineer

After many substitutions and adaptations, there was produced the ½-watt walkie-talkie and 6½-watt companion mobile units illustrated. Principal need for these sets was to direct dredging operations in the vicinity of power cables in the Willamette River and the mile-wide Columbia River. The equipment at once became invaluable for this purpose and many other uses immediately developed. It is now used regularly by field crews for switching, dispatching of emergency crews, surveying rights-of-way, etc., and at times when other means of communication are insufficient or nonexistent.

The walkie-talkie weighs 15 lbs. and is 6 in. deep, 7 in. wide and 12 in. high. Either of two shortened aerials can be used, one 71½ in. and one 47¼ in. Both have loading coils for top loading. The adaptation of the walkie-talkie to the company's frequency of 35,140 kc. presented its difficulties along with the parts problem, but was successfully overcome. The walkie-talkie and mobile set both operate from either self-contained batteries or 110 volts, a-c.



CHASSIS of 6½-watt, 4-tube transmitter and 9-tube receiver. Microphone is a Western Electric carbon in French hand-set combination shown in use at left

The two transmitter-receivers make a very reliable combination within a reasonable distance coverage and excellent contacts have been made at a distance of 2 mi. Contact is possible at even greater distances in good line of sight. The sets have proven very satisfactory for the original purpose of their design. It is the opinion of the writer that after the war when materials become available, that many such sets will be built and used extensively in construction and maintenance work where direct communication is a factor, not only in carrying out the work, but in safety, also.

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Oils and Lubrication of Steam Turbines—I

By A. F. BREWER*
Technical and Research Division, The Texas Co., New York City

1—Conditions Affecting Oil Performance.

Effective retention of maximum lubricating ability of mineral oil in service is the prime requisite for satisfactory lubrication of a steam turbine.

The conditions which promote lubrication failures, in more or less the order of their occurrence, are noted herewith. Any one may develop independently of the others; it depends upon the severity of the cause and the ability of the oil to resist the injurious effects.

* First of a series of nine articles treating the oils and conditions which affect the proper lubrication of steam turbine.

For the modern high-speed steam-driven turbo-generator units experience indicates that the practicable viscosity ranges (in seconds, Saybolt Universal at 100 deg. F.) are from 140 to 170 and from 175 to 250.

For steam turbines with gear drive, as for propeller shafts, pumps and low-speed generators, a higher viscosity is necessary if the oil must serve the dual purpose of lubricating not only the bearings but also the gears. Here again the Saybolt viscosity range is divided to provide an oil around the lower limit from 250 to 350 seconds, and one within the higher range from 400 to 550 seconds.

Emulsification

Turbine bearing lubricating oil circulates at a rate of around 400 gallons per minute in average power plant service. The lubricating system is designed to prevent excessive surge and normally, the volume of oil in reserve is sufficient to allow for an ample period of rest before recirculation. And yet, there is sufficient turbulence to enable an oil-water emulsion to persist if the oil emulsifies readily and water is present. As emulsification is one of the contributing factors in sludging, the oil should be resistant to emulsification and such emulsions as may form should separate readily. This is denoted by the demulsibility.

Foaming

Foaming indicates that air is being retained by the lubricating oil. It is unsightly, dangerous, wasteful, impedes oil flow to bearings, and causes erratic action of the governor.

These conditions favorable to this action are mainly mechanical and dependent upon maintenance. They include:

a. Air leakage into the oil pump suction line.

b. Low oil level, permitting the pump suction inlet to become exposed.

c. Insufficient venting of the lubricating system.

d. Excessive drop from oil return lines to pump.

e. Oil return lines of insufficient size or capacity.

f. Discharge velocity from pressure regulating valve too high.

g. Contaminated oil.

h. Running the pump at excessive output.

Maintenance is responsible for the correction of these conditions. Maintenance is also responsible for the manner in which fresh oil is added. This can be another cause of foaming. Wide differences in temperature between the fresh oil and the oil in the system also contribute.

Oxidation

All mineral oils will be subjected to more or less oxidation when agitated with water at normal operating temperatures in the presence of air. The rate of oxidation is known to roughly double with each increase of about 20 deg. F. in temperature of the oil, other conditions being the same.

Oxidation is accelerated by the effect of certain metals, especially copper, brass, bronze, and iron; or foreign matter such as dust, dirt and moisture. They are co-partners of oxidation in producing resultant insoluble sludges.

The logical procedure is to purify the oil during operation to a sufficient degree practically to eliminate water, emulsion, and foreign matter as rapidly as they are introduced.

Sludge Formation

Sludge, as it may be developed when a turbine oil is agitated in the presence of air or water, especially under overheated conditions, is formed in two stages:

1—The colloidal or soluble stage, which is more or less of a primary development.

2—The insoluble stage wherein the sludge becomes permanent in form.

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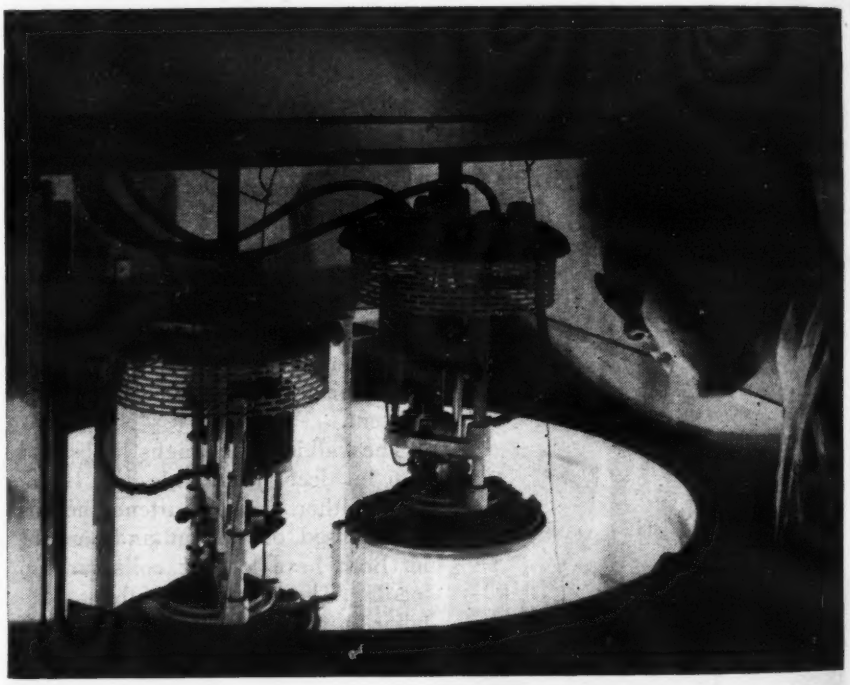
Weather-ometer Reproduces Elements



APPARATUS controls cycles of exposure to sunlight, moisture, heat and cold

The Weather-ometer, a new testing device in the laboratories of the General Cable Co., is a piece of apparatus to accelerate the natural aging effects of wire for laboratory study. The cable engineer with this unit duplicates in a few days those conditions met in long cycles of exposure to the natural elements of nature.

Chief features of the Weather-ometer are:

1. Twin arc lamps producing radiant energy equal in intensity and distribution to June sunlight at high noon.

2. Controlled temperature as high as 160 deg. F.

3. High humidity.

4. Intermittent periods of dry heat and thermal shock from a cold spray controlled by automatic cycle timer.

The large drum holding the samples, which may be in the form of straight lengths of cables, wires placed under stress by winding tightly on glass rods, or coatings painted on

metal panels, rotates slowly around the arc lamp. To complete the weathering cycle, the drum and samples are removed from the unit and placed in an adjoining refrigerator at sub-zero temperatures for certain prescribed periods of time and then replaced in the Weather-ometer. This test is sometimes supplemented by further sunlight investigations using strong ultra-violet radiation from a mercury vapor lamp.

This piece of apparatus is developed at a particularly important time since it facilitates the testing and development of certain compounds such as synthetic rubber which, unless properly compounded, are subject to cracking caused by sunlight.

Certain types of cable are protected by paints against the ravages of corrosion. These materials are subjected to predetermined and automatically controlled alternating periods of water spray and dry sunlight. Every day the samples are closely analyzed for signs of oxidation or other deteriorating effects. Still other cables are weatherproofed by impregnation with asphaltic, bituminous, or synthetic materials, whose resistance to weathering is similarly determined.

This test is sometimes supplemented by further sunlight investigations using the strong ultra-violet radiation from a mercury vapor lamp. These accelerated procedures are continually compared with long-time natural weather exposure tests on duplicate materials or cables.

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Template Gives Cable Tension

By ARCHIE BENJAMIN
*Distribution Engineering Division**
Quebec Hydro-Electric Commission

Pulling tensions in 189 lengths of 120-kv. oil-filled cable were measured and recorded without causing any delay to the installers.

A rugged dynamometer reading in pounds and equipped with a maximum-recording needle was connected between the pulling-eye in the manhole wall and the pulley-block. However, the reading gave the tension in the pulling rope or cable directly only when the angle θ made by the rope around the pulley was 120 degrees. For other values of θ the reading in the dynamometer (Fig. 1) had to be multiplied by a correction factor K to give the pulling tensions.

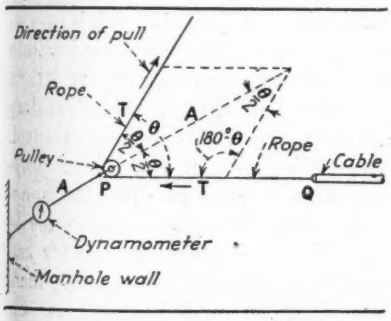

FIG. 1. Dynamometer gives indication of cable pulling tension but reading T must be multiplied by constant $K = \frac{1}{2 \cos \theta/2}$

This correction factor K is given by

$$K = \frac{1}{2\left(\cos \frac{\theta}{2}\right)}$$

and

$$T = A \frac{1}{\left(2 \cos \frac{\theta}{2}\right)}$$

where T = tension in cable in pounds
A = dynamometer reading in pounds
θ = angle made by pulling rope around pulley.

In order to determine the tensions quickly in the field, a wooden template was made in the shape of a right-angle isosceles triangle (Fig. 2) which was used as a protractor to measure the angle θ and which was graduated to give directly the value of K for every 5 degrees. Using the hypotenuse of the triangle as a base and placing the centre of this hypotenuse at the pulley any value of K for angles from 0 degrees to 180 degrees could be read and the tension determined by multipling K by the dynamometer reading.

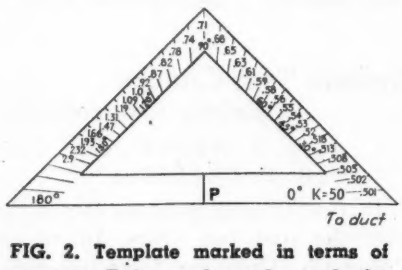

FIG. 2. Template marked in terms of constant K for each angle made by rope as it enters and leaves pulley. The hypotenuse edge is held coincident with the rope between the pulley and the cable; the point P is matched with the intersection point P of Fig. 1 (not the axle of the pulley)

* Electrical Department

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Metallic Sheaths, Shielding Grounded

1. General *

RICHARD C. WALDRON,
Assistant to the Chief Engineer
The Okonite Co., Passaic, N. J.

Electrostatic shielding is provided for certain types of insulated cable to improve the electrical characteristics, to improve the surge resistance of the cable and to provide increased safety to human life. Any metallic or conducting covering must be treated as shielding even though this is not its primary function. To perform satisfactorily, it must operate at or near ground potential at all times.

The shielding may be applied as shielding tapes in non-metallic sheathed cables or on the individual conductors of multi-conductor metallic sheathed cables. It may also be applied for other purposes and still serve as a shield; two examples are the lead sheath of paper or varnished cambric cables and the steel tapes of parkway cables.

The shield or metallic sheath of multi-conductor cables should be solidly grounded at each joint. Frequent grounding provides multiple ground return paths for fault currents and reduces the possibility of open sections of shielding on non-loaded cables. Insulating joints may be inserted to isolate earth currents or to permit cathodic protection.

Single-conductor installations must be studied to determine the best method of grounding or bonding the shielding or sheath. There will be an induced voltage in the sheath of a single-conductor cable carrying alternating current due to mutual induction between its sheath and conductor and the current flowing in any other conductors in its vicinity. This induced

* Beginning a series of five articles covering the problems of grounding or shielding of cable sheaths.

voltage can result in two conditions:

1. Sheaths bonded or grounded at more than one point have circulating currents flowing in them, the magnitude of which depends on the mutual inductance to the other cables, the current in these conductors and the resistance of the sheath. This circulating current does not depend on the length of the cables nor the number of bonds, providing there are bonds at each end. The only effect of this circulating current is to heat the sheath and thereby reduce the effective current carrying capacity of the cable. If the sheath loss exceeds 5 percent of the copper loss, the current carrying capacity should be reduced or special means be provided to reduce this loss.

2. Sheaths bonded or grounded at only one point will have a voltage built up in the sheath. The magnitude depends on the mutual inductance to other cables, the current in all the conductors and the distance to the grounded point. This voltage may cause electrolysis of the sheath, cause discharge or be unsafe to workmen.

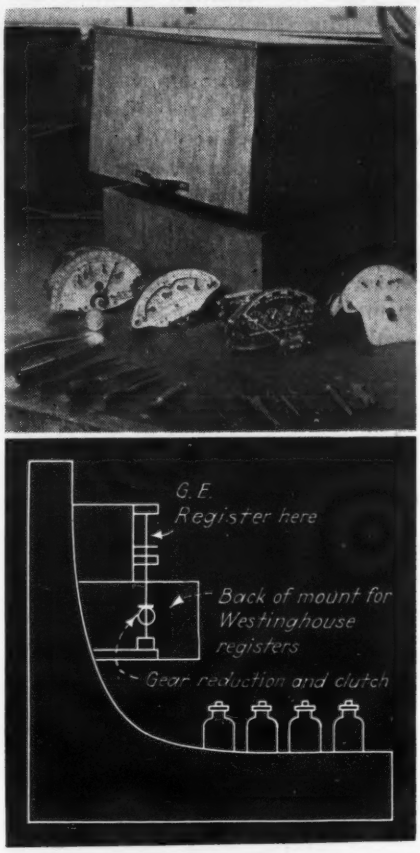
The usual safe potential is considered at about 12 volts for all metallic-sheathed cables in wet ducts. Higher voltages may be allowed for cables having non-metallic coverings over the shield particularly if in dry ducts or if the shield is covered by a moisture impervious insulating sheath. A maximum of 25 volts should not be exceeded for any condition.

•

Compact Demand Register Kit

On a system spread over a large area it is sometimes desirable to make special kinds of meter tests in the field rather than bring the work, perhaps from a long distance, into the headquarters laboratory—for instance, demand register checking. There is not a great deal of such work to be done on the system of the East Tennessee Light and Power Co. and the outfit for doing it is therefore not large. So that the testing facilities could be used in the field as well as in the laboratory, they were all assembled in one easily portable box.

The box is so designed, see sketch, that when the cover is removed there remains a desk-like affair on the back of which is a register drive on which either General Electric or Westinghouse registers may be mounted. In the base of the box are packed leads, bottles of oil and cement, special tools, all the paraphernalia used in register repair, maintenance and testing, including a neon lamp for checking the speed of register motors by stroboscopic effect.



DEVICES and supplies for demand register checking assembled in one box

The register drive is a regular General Electric checking device with a shaft speed of 30 5/9 r.p.m. To accommodate Westinghouse registers which require a shaft speed of 25 r.p.m., the mount for them is connected to the other through a gear reduction and a small friction clutch.

•

System Test Checks Relay Operations

By C. A. HUMMEL and H. E. CHAMBERS *

In a continuing program extending over the past two years, Interstate Power Co., Dubuque, Iowa has been installing modern automatic relay and control equipment at various parts of its system in an effort to improve service to customers. Early this year the equipment, installed in the Albert Lea, Minn., steam plant and at various related stations on the main 69 kv. transmission system between Albert Lea, Minn. and Dubuque, Iowa, was subjected to a system test to evaluate the capability of the Albert Lea plant to take care of sudden load changes caused by sectionalizing on the interconnecting transmission line and also to test the functioning of frequency relays which were installed to prevent overloading the plant.

The system on which the tests were conducted is diagramed in the accompanying illustration.

To demonstrate the ability of the Albert Lea plant to take on sudden load increases, this plant was, for the purpose of the test, first operated at its normal load of about 10,000 kw. Through pre-arrangement the Dubuque switch at the Independence station was tripped, dumping the load normally supplied out of Dubuque plant onto Albert Lea and increasing load at Alberta Lea to 14,000 kw.

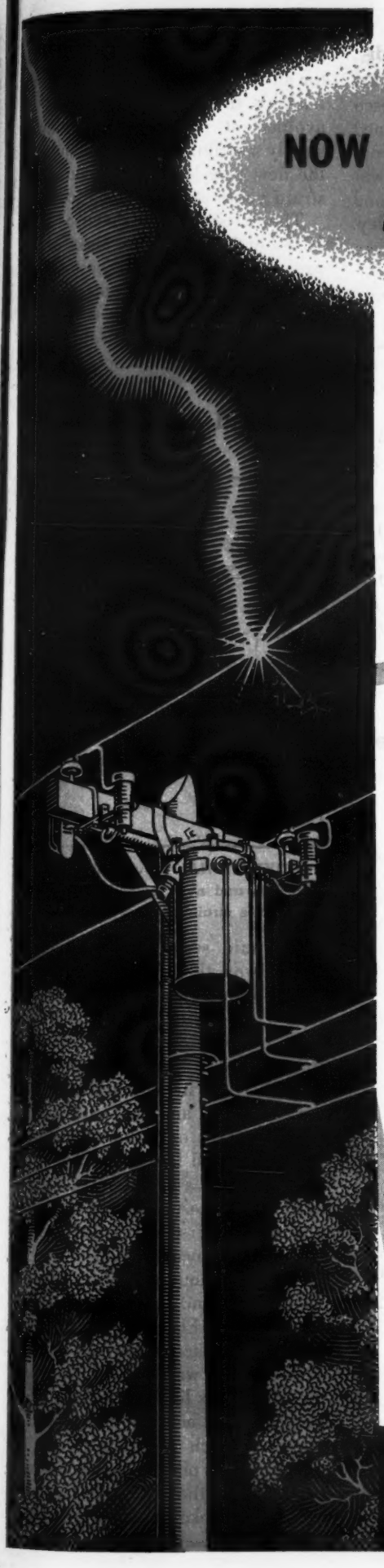
Results Following Load Change

Results following this load change were as follows: The voltage at Independence dropped approximately 4 volts; an amount well within the range of voltage regulators at Oelwein distribution substation. Steam pressure at Albert Lea dropped momentarily about 20 psi (450 psi. is operating pressure) but recovered within two minutes. Frequency at Albert Lea varied slightly, as this plant does not have automatic frequency control. The boiler control functioned properly with the exception that the equipment controlling gas input to one of the boilers went slightly too far and had to be adjusted by hand, as there was a slight defiiciency of air for good combustion. This condition was corrected.

After the plants had run for a short period, indicating that everything could be handled without strain, loads were redistributed so as to cause the least inconvenience and number of interruptions to customers while testing the frequency relays at Decorah and Spring Valley substations.

These relays come into action—to prevent too much loss in speed—if enough load is dumped onto Albert Lea plant to cause the turbines to lose speed and go off the line. They

* Chief Engineer, Relay Engineer respectively. Interstate Power Co., Dubuque, Iowa



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1. It preserves investments in costly or unreplaceable electric equipment.
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3. It reduces repair or replacement demands involving vital materials.
4. It prevents interruptions of indispensable power service to consumers.

ON DISTRIBUTION LINES

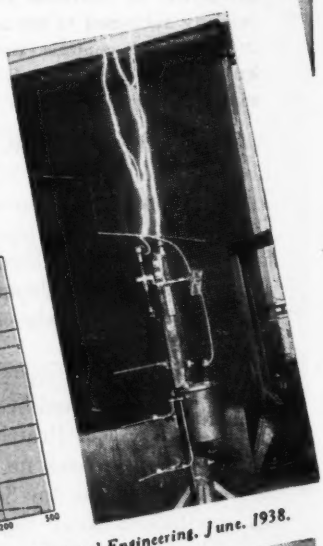
You can be sure of adequate protection with G-E pellet arresters

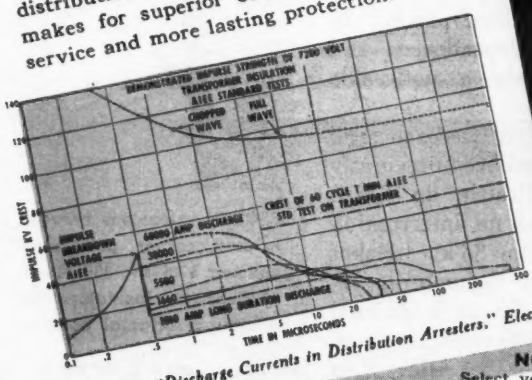
BECAUSE

1. **Pellet arresters limit stresses to less than half the impulse strength of the distribution transformer, even with severe lightning discharges.** (In the graph below, the impulse volt-time oscillograms of the 9-kv pellet arrester are compared with the volt-time impulse test strength of a 7200-volt distribution transformer. No other distribution protective device assures such a large margin of protection.)

2. **Pellet arresters have large discharge capacity.** Pellet arresters withstand severe lightning strokes. They have discharge capacity in excess of the highest lightning discharge currents measured on distribution circuits.*

3. **Pellet arresters have valve action.** The best arresters ever made—those used for protection of the most costly power apparatus—have always been of the valve type. In distribution arresters, too, valve action makes for superior continuity of power service and more lasting protection.





*See "Discharge Currents in Distribution Arresters," Electrical Engineering, June, 1938.

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Select your G-E pellet arrester from Bulletin GEA-2975. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

do this by sectionalizing the 69-kv. line at Decorah and Spring Valley.

To make the frequency relay check the Dubuque and Albert Lea plants were operated separately by opening a breaker at Independence. The Albert Lea turbine speed was reduced to approximately 59.3 cycles, causing the frequency relays at Spring Valley and Decorah to begin to operate. Thirty seconds after these relays had started, the 69-kv. breaker at Decorah, supplying the line toward Independence tripped and the 33-kv. breaker

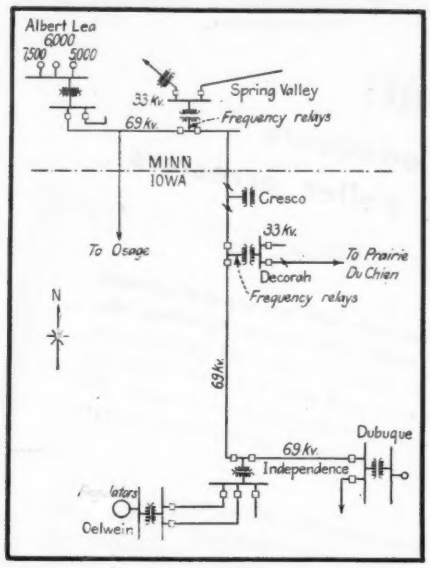

DIAGRAM of Interstate Power system recently subjected to test to prove ability of plant controls and relays to handle load swings and faults on interconnecting transmission lines

supplying the Prairie du Chien connection also tripped. Since previous arrangements had been made, the Independence operator promptly closed in on the Decorah line, picking up load between Independence and Decorah with barely a noticeable flicker in the lights.

The load between Decorah and Prairie Du Chien had been previously switched to the Prairie du Chien source so there was no interruption on these towns but the 33-kv. breaker as mentioned went through its required operation. In an additional thirty seconds the 69-kv. breaker connecting Decorah to the Albert Lea source tripped, the 69-kv. breaker on the Independence line immediately closed, and the 33-kv. breaker normally feeding the line toward Prairie du Chien also reclosed.

This operation prevented nothing more than a momentary interruption to Decorah distribution. In an additional thirty seconds the 69-kv. breaker on the line toward Cresco and Decorah at Spring Valley opened and left Albert Lea serving the connection to the Central States Power & Light at Osage and the 33-kv. and 13.2-kv. system out of Spring Valley.

Operations Relieve Plant

This series of operations relieved the Albert Lea plant of a total of 4,000 kw. of load, and clearly demonstrated what would happen in case faults developed on the interconnected system and what should be expected by operators at Albert Lea plant. The test proved that the total elapsed time of one minute and 30 seconds is short enough to avoid serious trouble or damage at Albert Lea plant because of severe overloads on equipment there and approximately a long enough interval to avoid unnecessary sectionalizing through momentary faults.

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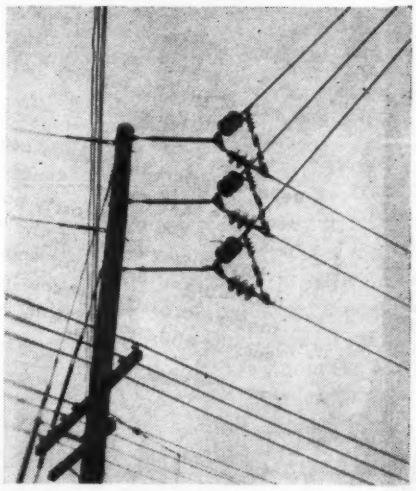
Extensions Solve Relocation Problem

By J. J. GRAVEN

Distribution Engineer
Central Illinois Electric & Gas Co.
Rockford, Illinois



STRAIN extensions brought out from relocated corner pole avoid need for splicing 13.8 kv. 336 M circ. mil. ACSR conductors. Insulators and conductors remain in original position

The accompanying illustration shows the construction used by Central Illinois Electric & Gas Co., Rockford when repaving of a city street made it necessary recently to move a 13.8 kv. corner pole back about four feet from its original position.

Necessity of making six splices in the 336,000 circ. mil. ACSR conductor and resagging to carry conductors back to the new pole location was avoided at considerable saving by simply running extensions out from the new pole location to connect the strain yokes at the original corner.

The extensions consisted of 36-in., 18,000-lb. Austin strain links of compressed Bakelite and asbestos which were fastened by appropriate fittings to $\frac{3}{4}$ x 14-in. eye bolts in the pole and to clevis eye fittings at insulator strain yokes. Conductor tension is 2,000 lb.

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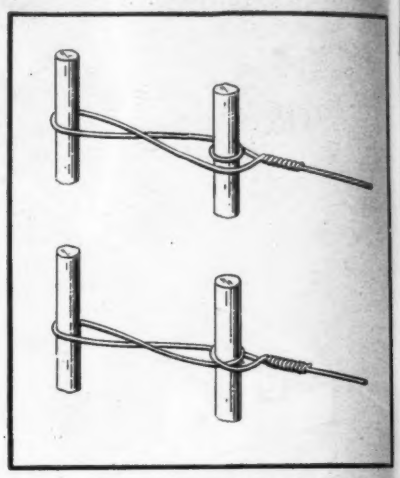
Deadend Equalizes Strain on Pins



CONVENTIONAL double-pin deadend (above) and new method (below) that equalizes strain on pins

It would seem from examination of the way the wire is looped in a conventional double-pin deadend such as is commonly used on short-span distribution circuits, that the front pin would take most of the strain. The wire is snubbed around the front pin and the back pin apparently takes only the strain of the free end which is served back on the span run. Yet a heavy pull on such a deadend will usually break the back pin, not the front one, proving that the strain is unequally divided.

A better manner of making a double-pin deadend, now in use by the Appalachian Electric Power Co. is shown in the accompanying diagram. This method was devised by one of the company's linemen and tests have proven that it actually does distribute the pull much more uniformly between the two pins than does the usual method. In the tests the front and back pins broke an equal number of times.

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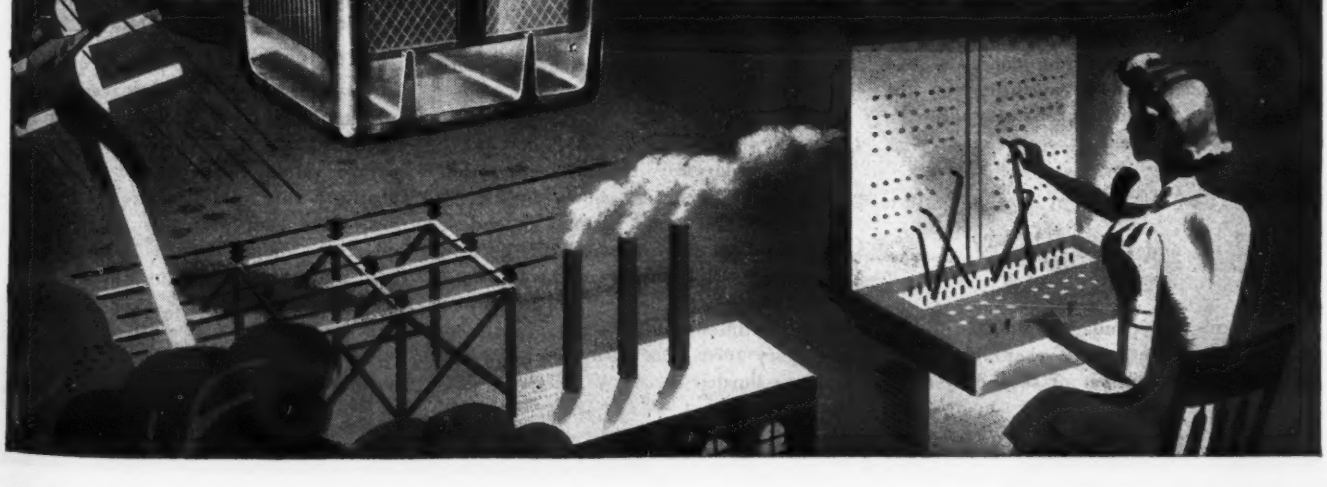


CHARACTERISTIC CURVES FOR BUSHING CURRENT TRANSFORMERS

By S. D. MORETON, Relay Engineering Division, General Electric Co., Philadelphia, Pa.

A plastic template (Fig. 1) has been designed for drawing excitation and ratio correction factor curves on special logarithmic coordinate paper as shown in Figs. 2 and 3.

Excitation Curves

Shape of the completed excitation curve (Fig. 2) depends solely upon the

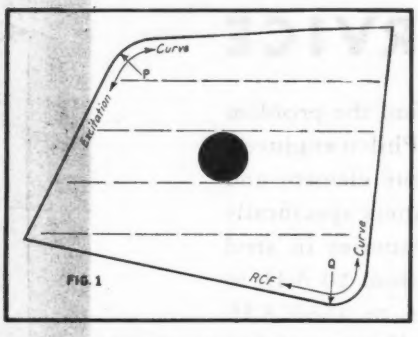


Fig. 1—Template for bushing current transformer curves to be used only with coordinate paper designed especially for this template as described

magnetic properties of the iron in the transformer core and the "log-log" coordinates. Relative locations of the curves in the coordinates depend upon the dimensions of the core and the number of secondary turns. Consequently, one template (Fig. 1), upper edge, the shape of which is determined by the magnetic properties of the iron in bushing transformers, can be used as a guide for drawing all curves of the "family" if one reference point, P, is marked on the template and its coordinate calculated for each curve.

For convenience, the point P has been selected at an excitation corresponding to the maximum permeability of the iron. The coordinates of this point on "log-log" paper are:

$$E_s = \frac{CN}{20}$$

$$\text{and } I_s = \frac{D}{20N}$$

where

E_s = secondary voltage
I_s = secondary exciting current
N = number of secondary turns
C and D = constants for given bushing-transformer, dependent not only upon the iron magnetic properties, but also upon the core dimensions, at 60 cycles frequency. Values for various G-E bushing transformers are given in an especially prepared bulletin which also includes the plastic template and pads of the coordinate paper. The information contains in tabulated form the necessary transformer constants.

For other frequencies, multiplying factors are provided.

For drawing the curves, it is necessary, therefore, only to look up these con-

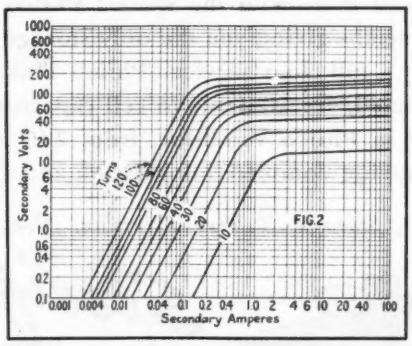


Fig. 2—Typical excitation curves for respective turns of a bushing current transformer

stants in the table for the type of breaker and rating involved, calculate E_s and I_s for the values of N desired and plot this point on a sheet of the special coordinate paper. Set the template with its reference point, P, on this point on the paper, see that its guide lines are parallel with the paper lines, and draw the complete curve, using the template as a guide.

RCF Curves

In a similar way, the ratio correction factor (RCF) curves, shown in Fig. 3, also have the same shape, dependent upon the magnetic properties of the iron in the core. Here, however, the locations in the coordinates depend not only upon the core dimensions and the number of secondary turns, but also upon the impedance burden in the secondary circuit. The template, lower edge, can be used as a guide for drawing all the curves in this family too if Q is the reference point and all its coordinates are calculated for each curve.

The equations for calculating these coordinate values are:

$$\text{Percent } I_s = \frac{CN}{Z}$$

$$\text{and RCF} = 1 + \frac{D}{N\,(\%I_s)}$$

where

Percent I_s = secondary current in percent based on 5 amperes
Z = secondary impedance in ohms, including the internal leads of the transformer
RCF = ratio correction factor
C, D, and N = same as for the excitation curve

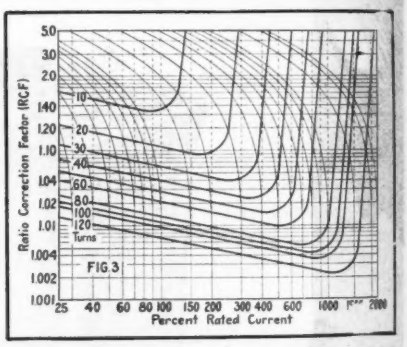
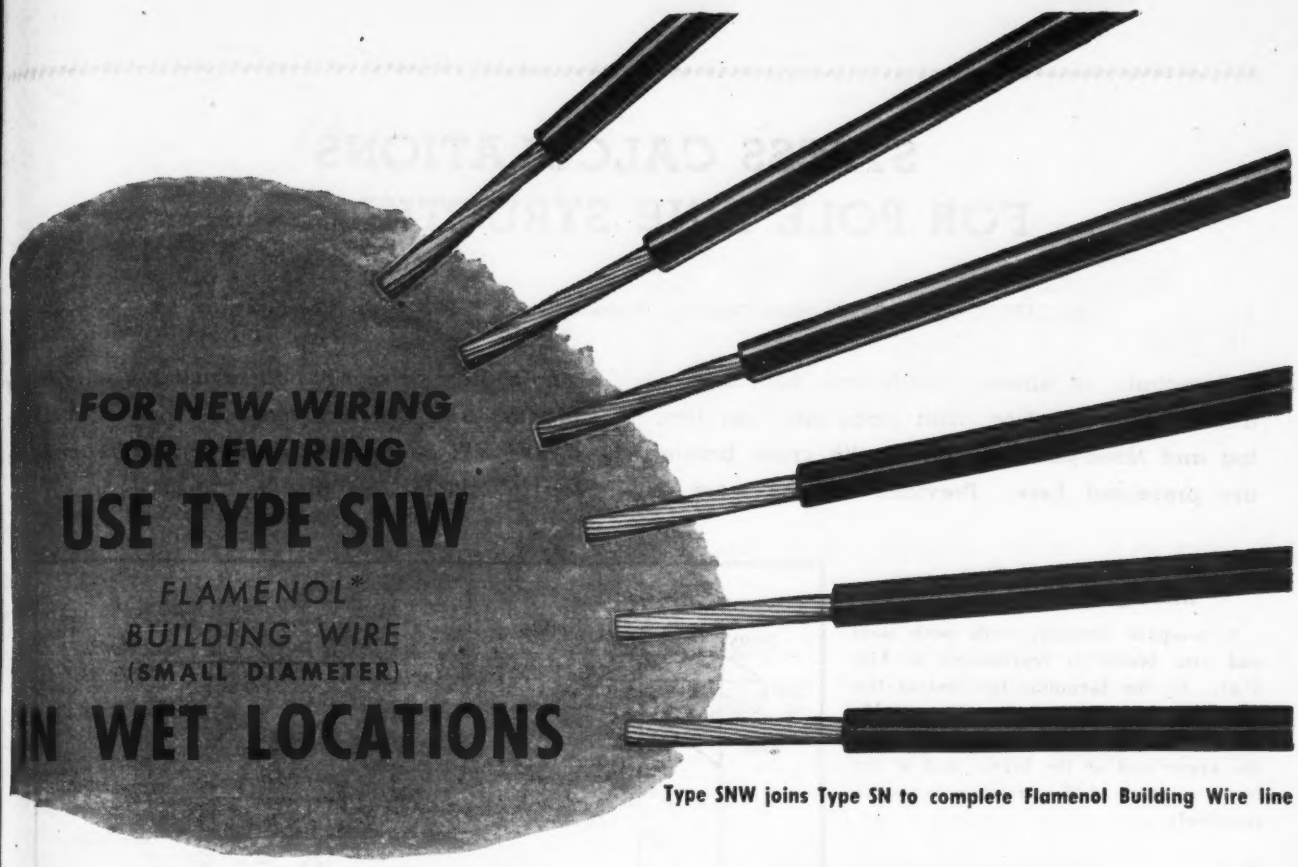


Fig. 3—Typical ratio correction factor curves; solid line primary coordinate, dotted line secondary coordinate

It is necessary, therefore, as before, only to obtain the constants from the table, calculate the corresponding percentage value of the secondary current, substitute this value in the RCF equation, solve, and plot this point on the coordinate paper in the manner outlined above. It should be noted that no curve can extend to an RCF value less than unity, and that N must be the actual number of secondary turns of the tap involved.



Type SNW joins Type SN to complete Flamenol Building Wire line

Here is the ideal wire to use in raceways in wet locations in your plant for new wiring or rewiring. Its small diameter and smooth finish make it easy to install. It can be depended upon to give long service. It is approved by the Underwriters' as listed in the 1940 N.E.C. in sizes 14 to 4/0 inclusive for use in raceways as follows:

1. Underground
2. In concrete slabs or masonry in direct contact with the earth
3. In wet locations
4. Where the condensation and accumulation of moisture within the raceway is likely to occur.

Whole wiring systems can now be made up of Flamenol Building Wire using Type SNW Flamenol wire for wet locations and standard Type SN Flamenol wire for dry locations. The thermo-plastic insulation of both wires has long life, is high in dielectric and mechanical strength and resistant to oils, acids and alkalies. In addition, the insulation of Type SNW Flamenol wire has low moisture absorption.

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For further information on Flamenol Building Wires, Type SNW and Type SN or on building wires Type R and Type RH, see the nearest G-E Merchandise Distributor or mail the coupon.

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STRESS CALCULATIONS FOR POLE LINE STRUCTURES—V*

By CARL G. ERICKSON, Electrical Engineer, Northern Indiana Public Service Co., Hammond, Ind.

Essentials of stress calculations for two-pole transmission structures with cross and arm bracing and three-pole structures with cross bracing are presented here. Previous articles were on single poles, also two-pole structures with bottom bracing and bracing near the top. Concluding article will cover two-pole structures braced from top to bottom.

Two-Pole Structure With Cross Bracing and Arm Bracing

A two-pole structure with both pole and arm braces is represented in Fig. 5(a). In the formulas for finding the upper plane of contraflexure M_G and M_B are the resisting moments of the pole at the upper end of the braces and at the lower member of the crossarm truss, respectively.

$$R_1 = \frac{7\,(200 + 200) + 3\,(300 + 300 + 300)}{14} - \frac{300 + 300 + 500 + 500 + 500}{2} = 657 \text{ lb.}$$

$$R_2 = \frac{7\,(200 + 200) + 3\,(300 + 300 + 300)}{14} + \frac{300 + 300 + 500 + 500 + 500}{2} = 1{,}443 \text{ lb.}$$

$$H_1 = H_2 = \frac{2\,(200) + 3\,(300)}{2} = 650 \text{ lb.}$$

The increased horizontal forces at "a," "a_1" "b," and "b_1" on account of horizontal reactions H_1 and H_2, see Fig. 5, (b) should be found. Moments are to be taken about joints "a" and "a_1" to find the increase at joints "b" and "b_1":

(650 x 3)/4 = 487 lb., which added to 200 lb. = 687 lb. See Fig. 5(c).

From moments about joints "b" and "b_1", forces at joints "a" and "a_1" are (650 x 7)/4 = 1137 lb. Load and stress diagrams for this portion of the structure are shown in Figs. 5 (d) and 5 (e) respectively. Stress calculations for the balance of the structure may be made as described for Fig. 4 (g) and 4 (h).

Three-Pole Structure With Cross Bracing

A three-pole structure with cross bracing only is shown in Fig. 6 (a). While the applied horizontal loads are equal these loads are not distributed equally to each of the three poles by this type of bracing. This unequal distribution of the load tends to distort the structure as shown. The plane of contraflexure is lower on the middle pole than on the other two poles, and the location of the greatest pole bending stress is likely to be at the lower brace joint of the middle pole.

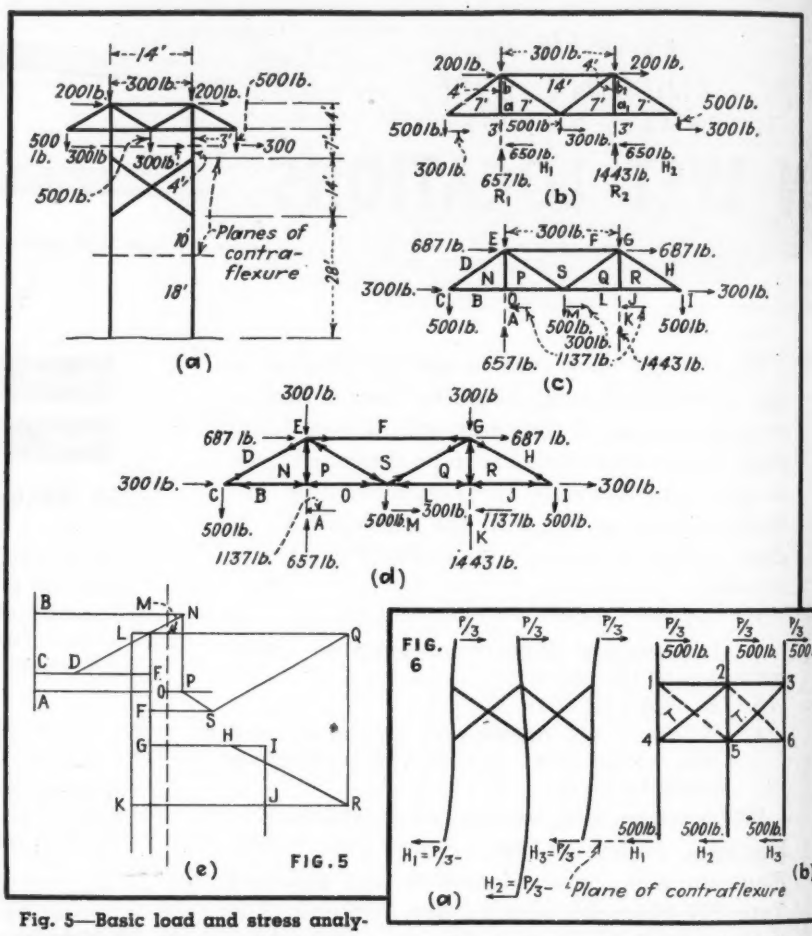


Fig. 5—Basic load and stress analysis diagrams for two-pole structure with conventional cross bracing and arm bracing

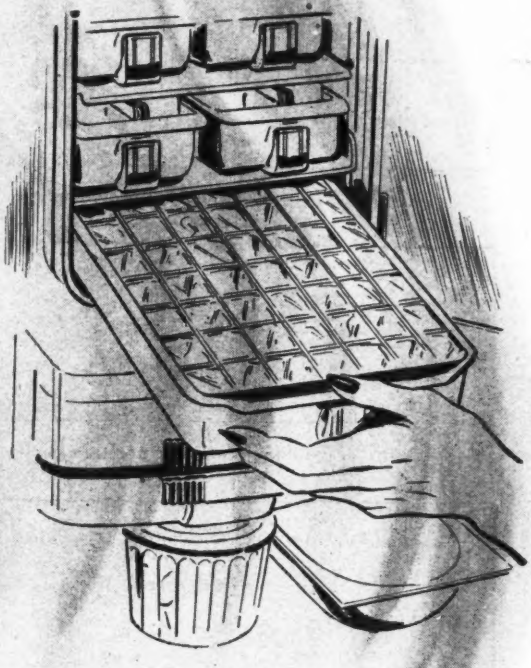
Fig. 6—Three-pole structure load diagrams where conventional cross bracing is located at top of structure

To eliminate the possible overloading of the middle pole and the high stresses in the brace members, the bracing may be designed as shown in Fig. 6 (b), in which case all the horizontal reactions are equal, and the plane of contraflexure passes horizontally through the three poles. The increase in loads at joints 1, 2, 3, 4, 5, and 6 are calculated as explained above.

*This series began in *Electrical World*, May 13, 1944 issue, page 110.

HEAT—

Aluminum helps use or lose it



Heat aluminum at one spot and it's soon hot all over; this metal's such an excellent conductor of heat. Manufacturers of appliances take advantage of this property of aluminum to insure uniform heating, where they're employing heat, or to dissipate it, where heat isn't wanted.

The aluminum flatiron sole plate is a highly efficient worker of the first class. You get quick, even heating without hot spots. Refrigerator ice cube trays and grids carry heat away rapidly, giving faster freezing.

This property of aluminum has proved extremely valuable in such wartime products as intercoolers and oil coolers on airplanes, superchargers on Diesels and heat exchangers in processing equipment. The ability of aluminum to speed dissipation of heat led to its early adoption for automotive and airplane engine pistons and cylinder heads. Postwar planners are incorporating aluminum in their designs for these same reasons. Winning the war comes first, of course. But aluminum is now being used for other-than-war purposes, as the manpower situation permits.

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ALCOA ALUMINUM

HOW TO MAKE A JOINT FOR SINGLE-CONDUCTOR, 600-VOLT CABLES

Outline of operations for jointing 1/0, 4/0, 350 M cir. mil, and 500 M cir. mil rubber cable. The procedure involves the use of a compression connector and has been adapted from construction standards issued by the transmission and distribution department of Boston Edison Co.

Procedure for making a joint is as follows:

1—(Refer to Fig. 1) Clean lead sheath before removing.

2—Remove sheath and factory tape on lead-covered cable (or braid on braid-covered cable) to rubber insulation.

3—Remove insulation to expose bare conductor for widths W shown in table

Cable size	1/0	4/0	350 Mcm.	500 Mcm.
Width, inches	1¾	2	2¼	2½

4—(Refer to Fig. 2) Install approved water-stop compression connector for wire size of conductors to be jointed.

5—Butt the conductors to the water-stop at the center of the connector.

6—(Refer to Fig. 3) On cables 4/0 and smaller make one indentation on each end of the connector. On cables larger than 4/0 make two indentations, half lap, on each end of the connector.

7—(Refer to Fig. 4) Clean insulation with the back of a knife.

8—Apply one coat of rubber cement over entire joint.

9—(Refer to Fig. 5) When cement is tacky apply three layers of moisture-resisting tape, ½ lap. When applying rubber tape use sufficient tension to reduce the width of the tape from ¾ in. to ½ in. In the process of taping fill the gaps G to the level of the connector.

10—Cover rubber tape with two layers of friction tape, ½ lap.

11—Cover the friction tape with two coats of P.B. paint. Allow the first coat to dry before applying the second coat.

12—No. 6 bond wire. If joint is between two lead covered cables, bond across the joint. If joint is between lead-covered and non-leaded cables, bond the lead sheath to the bare neutral, if one exists. When there is no bare neutral, bond the lead sheath to other sheaths in the manhole.

Construction Notes

1—To join rubber and lead cable to non-leaded cable follow the construction as shown.

2—To join rubber and lead cable to rubber and lead cable follow only the construction shown on left side of drawings.

3—To join non-leaded cable to non-leaded cable follow only construction shown on right side of drawings.

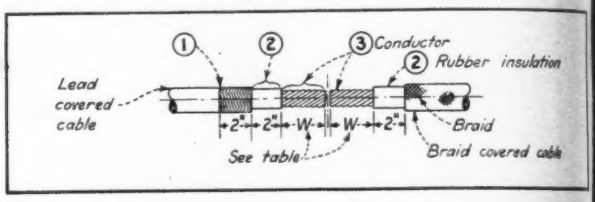


FIG. 1—Preparation of cable ends

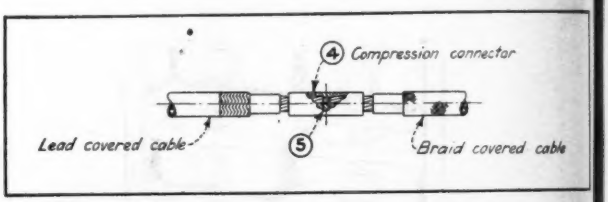


FIG. 2—Compression connector applied

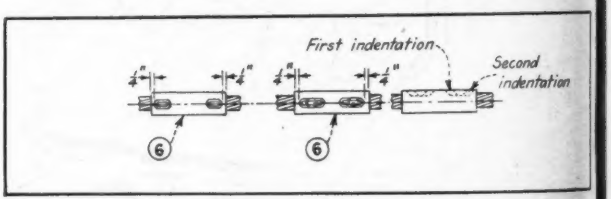


FIG. 3—Indentations on connectors

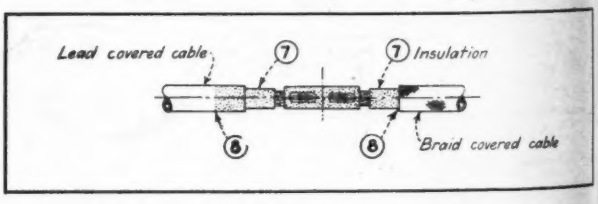


FIG. 4—Joint is prepared for insulation

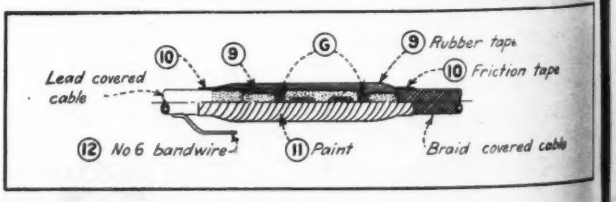
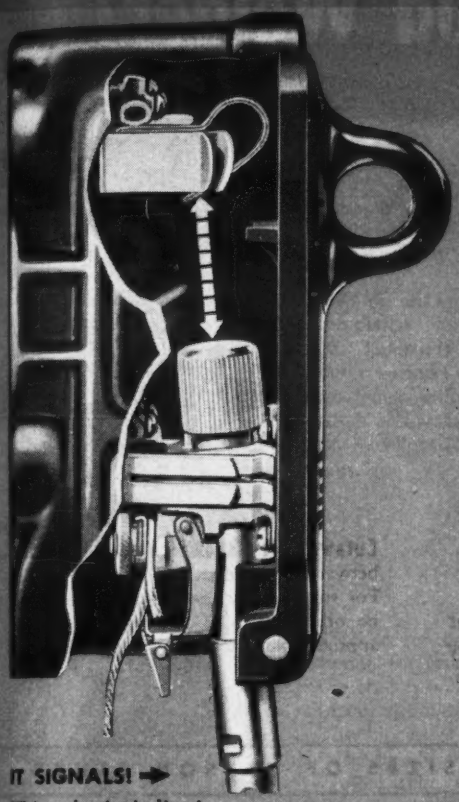


FIG. 5—Cross-section of completed joint

To Get 4-Way Protection*

Get L-M "PVD" Fuse Cutouts



IT SIGNALS! ➡
This tube in indicating position easily seen from ground—saves hunting, saves time.

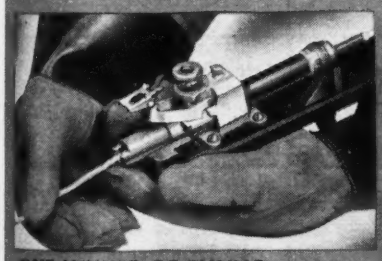
Check these advantages of using L-M "PVD" disconnecting Fuse Cutouts—instant, smooth, dependable action; protection to the cutout, which means long life; safe re-fusing; time saved in locating the blown fuse, and in replacing it, which helps restore service more quickly. That's why so many Utility Men prefer "PVD's," find it a sound investment to standardize on them.

L-M "PVD" Fuse Cutouts are made in four sizes: 5000-volt and 7500/12500-volt ratings, each in 50 and 100 ampere capacity. "PVD" Fuse Cutouts are outstanding in performance and service characteristics. Get the details. Ask the Line Material representative, or write Line Material Company, Milwaukee, Wisconsin, for complete information.

* 4-WAY PROTECTION

* **1. Protects the Line:** Instant separation of blown link . . . no arcing between contacts . . . smooth, positive dependable action.
* **2. Protects Cutout** itself. The Bakelite door is always closed . . . internal parts are always protected from dirt, weather, corrosion.
* **3. Protects the Lineman:** On-the-pole re-fusing is a safe, simple operation, even for a man with gloves on.
* **4. Protects your Service:** Dropped-out cartridge signals—easily seen from ground—avoids hunting. Re-fusing takes only 6 seconds with spare fused door—cuts outage time.

HERE'S THE CYCLE OF OPERATION

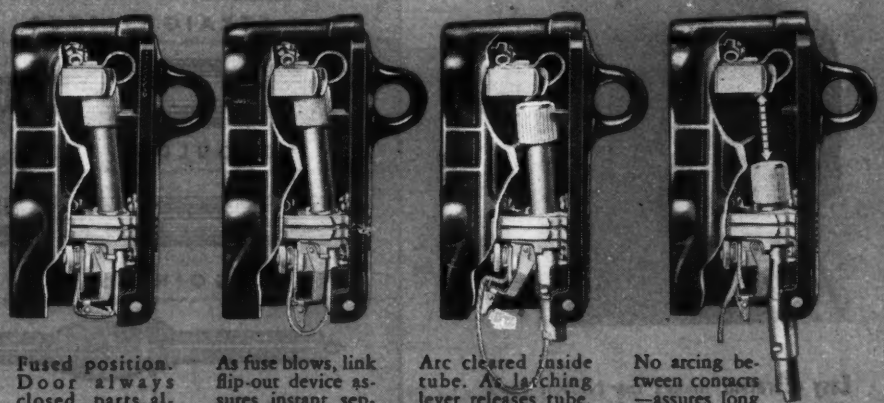


ONE-MINUTE RE-FUSING

On-the-pole re-fusing of "PVD" Fuse Cutouts is a safe, easy operation, is quickly done, even with gloved hands.

6-SECOND RE-FUSING

Lineman just opens and lifts off old door, and slams on spare fused "PVD" door. Bakelite doors interchangeable—save time in restoring service.



Fused position. Door always closed, parts always protected from weather, dirt, corrosion. *Operation is independent of door.*

As fuse blows, link flip-out device assures instant separation of blown link parts, before latching lever releases tube to indicating position.

Arc cleared inside tube. As latching lever releases tube, upper contact follows tube partway, gives extra time to clear arc, assures positive drop.

No arcing between contacts—assures long service. Cartridge drops to indicating position—easily seen from ground; leaves large gap between contacts.

LINE MATERIAL
FUSE CUTOUTS & FUSE LINKS

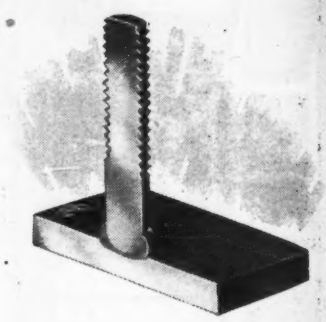
L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers • Fuse Cutouts and Fuse Links • Lightning Arresters Oil Switches • Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Street Lighting Equipment

SEE THIS "GUN" AT THE NATIONAL METAL CONGRESS CLEVELAND, OHIO OCTOBER 16-20

Studs end-welded in ½ second with the Nelson Stud Welder!

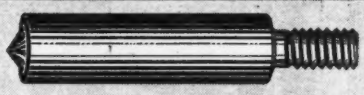
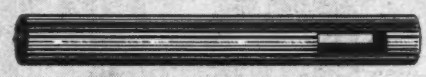
NELSON MODEL "H" STUD WELDER

Light in weight—completely portable, the Nelson Stud Welder is ideal for welding in any position. All Nelson Studs are used with the one gun, by simply interchanging chucks. Multi-gun units are available for production-line uses.



Cutaway view shows complete fusion between stud and metal . . . in ½ second. For strength, accuracy, and time-saving no other means of securing studs can approach this method.

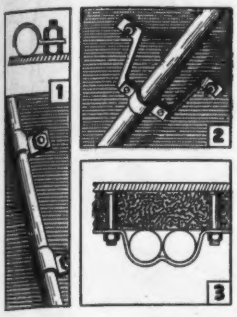
Easy operation makes the Nelson Stud Welder a versatile tool in the hand of any operator, experienced welder or not. 500 to 1500 studs can be welded by one operator per shift because it is simple and completely automatic.

TYPES AND SIZES OF NELSON STUDS	
STRAIGHT STUD	Diameters from 3/16" to ½". Threaded or blank. Lengths from 1" to 8".
 SHOULDER STUD	Diameters: 7/16" & ½". Lengths: Shoulder from ½" to 7"; extension from ¾" to 1¼".
 LAGGING STUD	Made to specifications. Lengths of 1", 2", 3" and 4". Diameter of ⅜".
METAL LATH STUD	Lengths of 1", 2" and 3", for various thickness of insulation. Diameter 3/16".

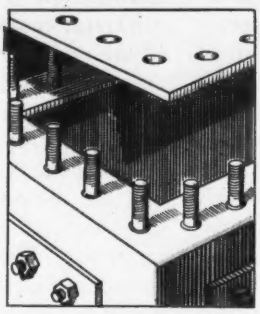
BENT STUDS, DRIVE SCREW STUDS, SPECIAL LENGTHS AND OTHER SPECIALTIES • *Write for complete details, or send us specifications and let us show how stud welding can help you.*

NELSON *Electric Arc*

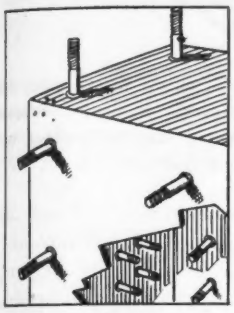
A FEW WAYS *460* INDUSTRIAL PLANTS AND SHIPYARDS ARE USING THE NELSON STUD WELDER!



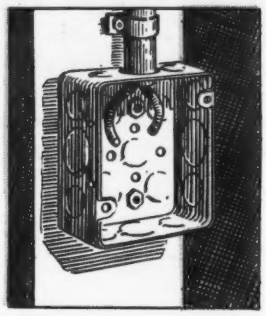
Wiring, conduit, and pipe are quickly secured. Here illustrated are a few methods: 1. Securing conduit. 2. Securing pipe (single and multiple runs). 3. Securing wiring of all kinds over soft insulation materials.



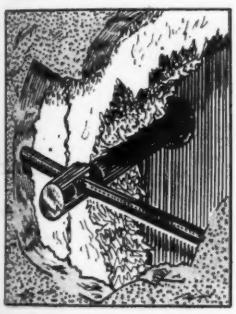
Inspection covers of all types can be secured with Nelson Studs. No drilling holes through casings, or hand welding studs. Studs are automatically welded in less than ½ second. No leaking or loosening.



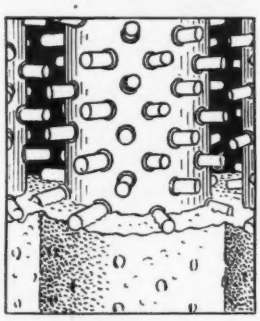
Metal boxes of all kinds can be made completely holeless and watertight. The studs are welded to the outer surface so the box can be secured to walls, etc. The interior studs secure various parts or panels. Excellent for electrical applications.



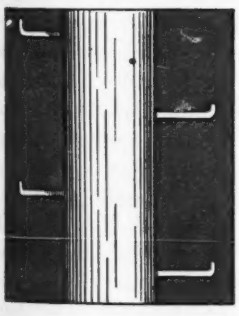
Electrical equipment of all kinds, outlet boxes, circuit breakers, etc., can be secured without drilling metal to secure them or welding on small pads. Accurate locating is easy because all Nelson Studs are pointed.



Lagging studs secure magnesia and other materials for insulation purposes. The stud is welded, and a wire slipped through the stud holes. The blocks of insulation are then placed under the wire and the wire pulled tight. Covering is then added. The hole may be located where desired on the stud. Studs also used to secure storm curtains in locomotive cabs.



Studding boiler tubes increases their efficiency. Studs act as reinforcement for the ceramic material which is put on to conduct heat to the tubes. The stud also conducts heat into the tube.



Bent studs for use as steps, etc., are available in several lengths. They are furnished bent and welded directly to metal. Wherever there is need for hooks or steps on metal frames, Nelson Studs of this type may be used with speed, economy, and assure through its welded strength great safety.

For general maintenance of all kinds the Nelson welder is excellent. It will end-weld studs to metal for any kind of repairs. For securing oil lines with straps; for inspection and ventilator covers; air lines; car repair; and for general work of all kinds around the shop.

FREE CATALOG AND SAMPLES

Complete details about how the 460 industrial plants and shipyards are making use of this stud welder may be obtained at once. *Write to:*

NELSON SPECIALTY WELDING EQUIPMENT CORPORATION

Dept. EW, 440 Peralta Ave., San Leandro, Calif.

Eastern Representative: Camden Stud Welding Corp., Dept. 122, 1416 South Sixth St., Camden, N. J.

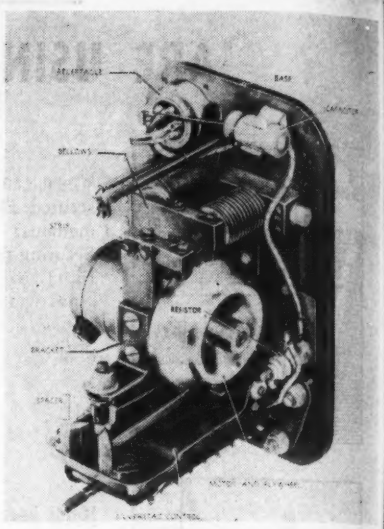
STUD WELDER

Gyro and Silverstat Make Hydraulic Servo

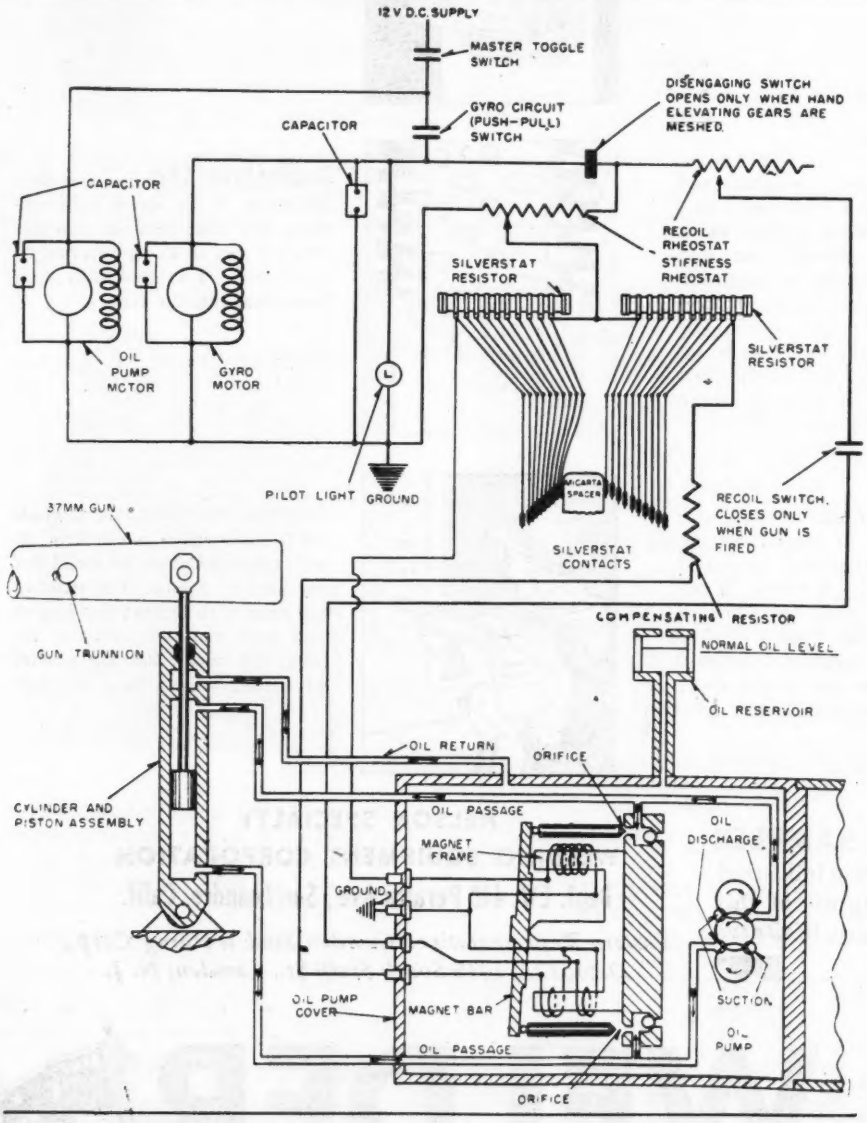
Much of the superiority in offense and consequent rapid advance of American tanks is now reported to be attributable to an ingenious servo-mechanizer which stabilizes the turret gun so that it is kept on the target no matter how rough the terrain. Several times as many hits can be registered as when using no stabilizer.

The mechanism which achieves this consists of an assembly invented by C. R. Hanna of the Westinghouse Research Laboratories and comprises a gyroscope, a Silverstat, an electromagnet, an oil pump and an hydraulic piston to tilt the gun up or down to compensate for the opposite motion of the tank vertically. Driven electrically at 14,000 r.p.m. the gyroscope precesses when the gun on which it is mounted changes angle in the vertical plane. A finger on the gyro-frame moves against one of the two groups of Silverstat contacts, shorting out some of the ohms of one Silverstat resistor and correspondingly increasing the current through one of the electro-magnets. Proportionate force is exerted on the appropriate needle valve and the oil pressure is therefore applied through the other orifice to the hydraulic cylinder. The gun is thus moved in such direction as to offset the up or down pitch of the tank.

Corrective action is proportioned to the velocity of the departure because the gyro precession is greater when the tank motion is more rapidly changing its longitudinal axis in the vertical plane. Thus more of the Silverstat resistance is cut out, more complete and quicker closure of the valve takes place and more differential pressure is exerted on the hydraulic piston. Compensation is provided for recoil and the unbalance that accompanies loading of the gun.



MONO-GYRO control shows motor and flywheel assembly in center, damping bellows above, Micarta spacer and silverstat control below



CYCLE OF STABILIZER operation hinges on precession of gyro actuating differential hydraulic cylinder through medium of Silverstat-controlled electro-magnetic valves

•

Fire Hazards And Their Elimination*

Rotating equipment, how to protect it and what to do if fire is detected, is discussed in this installment.

A. *Generators*—Fires in generators of steam and hydro-turbine units require immediate action to prevent extensive damage, owing to strong draft created by the forced-circulation air needed for cooling. Majority of modern turbine generators are equipped with internal water-spray manifold inside the end bells, getting water supply from plant service header. The more recent hydrogen-cooled generators are substantially free from fire hazard, because no oxygen is present to support combustion. Open-type generators driven by water wheels or diesel engines have no built-in facilities for extinguishing fire.

Immediately upon detection of fire, generator should be disconnected from line and turbine or engine shut down. Any dampers in air ducts should be tightly closed. If there are spray rings inside the end bells, the

*This series began in Electrical World, Sept. 2, 1944, page 100; adapted from "Handbook of Fire-Safety Practices for Public Utility Property," Ebasco Services Incorporated, New York, N. Y.

THE FIRST STANDARD LINE OF POWER BREAKERS

5 WITH 5 CYCLE OPENING SPEED

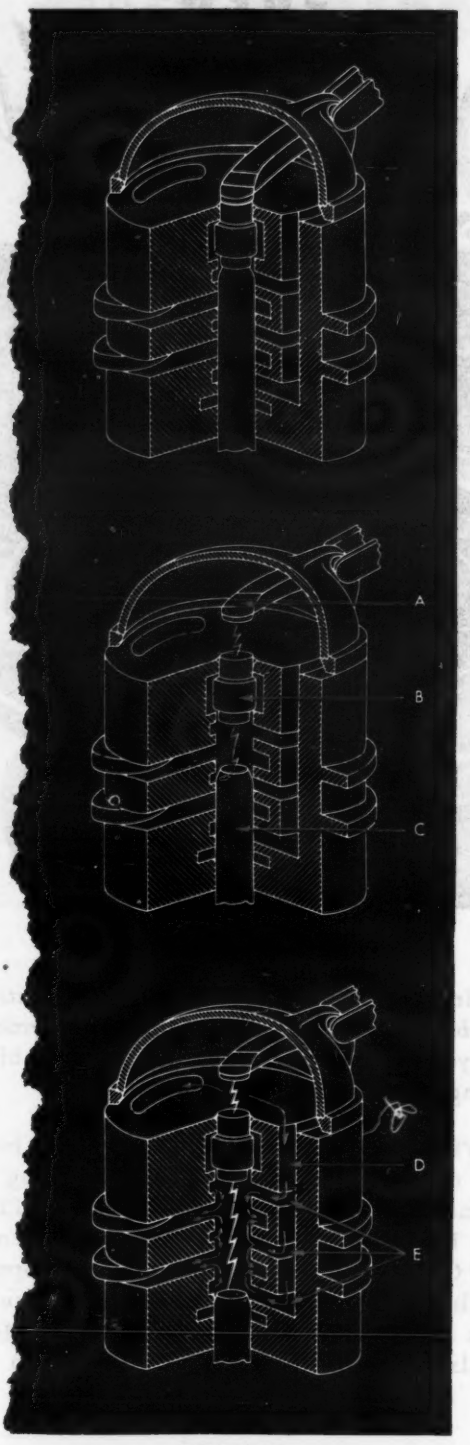
...thanks to this Multiflow "De-ion" action!

Westinghouse Type GM breakers provide —for the first time—a standard line of oil circuit breakers with 5-cycle opening time.

The secret of this faster opening speed is the new multiflow principle in the "De-ion" grids which extinguishes the arc faster by an oil flow which sweeps the arc products out of the vents. This produces an extremely high rate of deionization of the arc space at current zero (see panel at right).

Rated from 115 to 230 kv, these new Type GM breakers are actually smaller in size than the 8-cycle type they supersede, and require less oil and oil handling. Foundation size is reduced . . . maintenance is simplified by easier access to the grids and contacts. System stability is stepped up.

Most important, these new advantages have been made possible with no sacrifice in safety factor. Get complete information from your nearest Westinghouse office. Or write for D.D. 33-805. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.



HOW "MULTIFLOW" WORKS

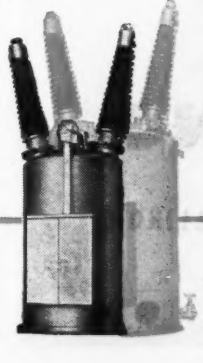
Contacts are closed. Equipment on the circuit operating normally and current is flowing through the breaker. But when some disturbance causes severe overload or short circuit, breaker trip coil is energized and contacts start to open . . .

As breaker opens, Contacts **A** and **B** separate, drawing an arc in the upper chamber, generating gas and creating pressure on the oil. Almost simultaneously, Contact **C** separates from Contact **B**, drawing an arc in the central orifice of the "De-ion" grid.

Oil pressure developed by the arc in the upper chamber forces oil through channels **D** into passages **E**. Oil flow (indicated by arrows) centers arc in the orifices, sweeps arc products out of the vents, and produces an extremely high rate of deionization of the arc space at current zero . . .

The dielectric strength of the gap at current zero has now been raised to the point where the arc cannot restrike, and the circuit is opened. The complete interruption takes place well within 50% of the grid, maintaining a large safety factor during normal operation.

J-60564



Comparative size of the new GM breaker (left) and the old 8-cycle model is shown at right.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

TYPE GM *Circuit Breakers*

WESTINGHOUSE PRESENTS—*JOHN CHARLES THOMAS SUN. 2:30 E. W. T., N. B. C.—"TOP OF THE EVENING"—MON. WED. FRI. 10:15 E. W. T. BLUE NETWORK*

T-K
BETTER ELECTRIC RANGE UNITS

A DEPENDABLE *Buying Guide!*

When considering an electric range, *focus your attention on the center of its heating units!* If you find the T-K "Symbol of Service" there, you'll know that range will give the highest degree of heating and cooking efficiency.

Chances are you'll see the T-K Symbol centered on the heating units on many of the finest ranges. They have long been standard equipment for the big majority of America's Electric Range Makers. They also lead the field for replacement and reconditioning! Capitalize upon the reputation and popularity of the T-K "Symbol of Service." Stock and feature T-K equipped Electric Ranges as well as T-K Replacement Units. May we send you details about our new dealer cooperation plan?

☆

TUTTLE & KIFT INC.

GENERAL OFFICES AND PLANT

1825 NORTH MONITOR AVENUE • CHICAGO 39, ILLINOIS

Makers of Electric Heating and Cooking Devices

valves in connection to source of water should be opened wide, including safety shutoff as well as control valve, and telltale or anti-leakage drain between these valves should be closed. If jumper hose is used instead of permanent piping connection, it should be coupled to fittings provided at generator and on water-main outlet. After opening valve wide, hose should be watched for excessive leaks or other defect.

Where no internal spray rings are provided, access cover plates on outer casings of generator must be removed for insertion of hose nozzle, or end bells must be removed if there are no access holes. Adequate access openings should be provided on all generators, fitted with quick-opening covers, since heat from a fire may make it difficult to remove ordinary bolted fastenings. Employees should be thoroughly familiar with methods of getting water to each generator in stations to which they are assigned.

Water and Coil Insulation

Clean water is not injurious to coil insulation, provided prompt attention is given to proper drying out before putting back in service. There should be no hesitancy in applying water immediately, after machine has been tripped off the line, since prompt action will greatly reduce the destruction of insulation and windings by an unchecked fire.

Where permanent carbon dioxide extinguishing systems are installed, operators should learn the features for automatic and manual control, and should carry out routine tests for assuring that controls are in proper order.

Steam, at low pressure and saturated or wet, has been used in place of water with internal rings or nozzles on older machines.

Portable first-aid extinguishers of carbon dioxide, dry compound or carbon tetrachloride types, have too small capacity to be effective on fires involving large generators; their use would be a serious waste of valuable time and should not be attempted.

In all cases, shutting off the air supply to generators is highly important for prompt extinguishment. This should be kept clearly in mind, particularly if it should seem necessary to remove end bells or casing plates to get access to windings for applying water, as with vertical-shaft hydro generators. In case there are no damp-

PRECISION-FABRICATED TO 3 DECIMAL TOLERANCES

Final Inspection — Micrometer indicators used to compare finished PANELYTE Barrel Support Block with metal template upon which test block is mounted.

PANELYTE* Propeller Barrel Support Blocks Stand Grueling Strain Without Deflection!

Vertical Milling — 3" and ¾" radii on PANELYTE Barrel Support Block milled to tolerance of ± .001" as curved surface must fit exactly to inside barrel contour.

Mass-produced from strong, fabric base PANELYTE — Barrel Support Blocks transmit heavy loads from the barrel to the spider of the Hamilton Standard Propeller used on bomber and fighter planes. Precision-fabrication is essential to assure accuracy of part — and exact balance in delicately adjusted assembly.

Manufacturing tolerances on length of support seat (cut-out section) in PANELYTE Barrel Support Block and on outside radius, which mates with barrel, are held to a total variation of .003" + .001" and — .002". Twelve different machining operations, including band sawing, grinding, sanding, drilling, counterboring and milling, are employed in the precision-fabrication of this intricate part. Rapid mass production is possible through new machining techniques and the enlarged facilities of the PANELYTE Plant.

The ready adaptability of PANELYTE to fine machining, dimensional stability — and economy — highly recommend it for structural parts of complicated design. Our engineering staff will be glad to explain how Precision-Fabrication guarantees accuracy in the most intricate of parts — often saves man-hours and money in production.

Write for factual "Data Book"

PANELYTE *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

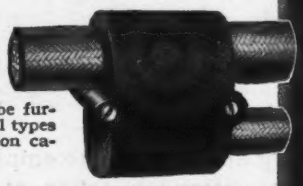
Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Mexico City, Montreal, New Orleans, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Toronto, Trenton, Vancouver

* MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS AND FABRICATED PARTS IN PAPER, FABRIC, WOOD VENEER, FIBRE GLASS AND ASBESTOS BASE LAMINATES

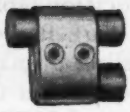
from the MOST COMPLETE line of Cable Taps

Now you can select from a really *complete* line of standard and special taps. Every one carefully designed and manufactured.

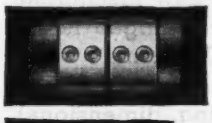
Parallel and 90° taps — and combinations — in the widest variety. For conductor sizes up to 1,000,000 CM.



Gutter Tap with Bakelite Cover. Insulating covers can be furnished for all types of Penn-Union cable taps.



2-way Gutter Tap. Main and branch sizes 8 to 1,000,000.



Two Separate Parallel Taps to a continuous main conductor.

Combination Cable Taps; one branch parallel to main, and one at 90°.

Hinged Clamp of Penn-Union Type HFM makes installation easy. Multi-slit tapered sleeve assures permanent grip on branch.

Positive Equalized Pressure on main and branch, with Penn-Union Type SM. Tightening torque is accurate measure of the clamping force.

Also the *most complete line* of Service Connectors — Terminals — and thousands of other fittings, for all requirements.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

ers in air ducts, recourse may be had to blankets or tarpaulins applied to either intake or discharge openings. Viscous-coated or oil-curtain filters, sometimes used in intakes of old generators, should be watched, as they may become ignited and augment the fire.

With hydrogen cooling, the primary danger of fire is from leakage at storage cylinders and connecting piping, especially at times when empty cylinders are disconnected and replaced with charged cylinders. If hydrogen storage is indoors, room should be thoroughly ventilated and open flames excluded while changing cylinders.

Hazards from lubricating oil systems will be as outlined in a subsequent article.

B. *Frequency Changers*—Same as for generators above.

C. *Motors*—Principal causes of fires from motors are:

a—Overload protective devices inadequate or defective.

b—Low-voltage protection inoperative.

c—Single-phasing of 3-phase motors protected by fuses.

d—Arcing or overheating of starting equipment.

e—Location of motor and starting equipment too close to combustible material, or in damp place.

f—Failure to use explosion-proof or splash-proof motors where necessary.

g—Accumulation of lint, dust or abrasive particles in motor windings.

Regular inspection of motors is essential for promptly detecting and eliminating potential causes of failure as outlined.

•

Welding Rods Capped Save 14 Percent

Welding rods are critical war material and a method for saving rod is to use each one down as far as practical and then cap it. No stub over two inches should be thrown away, according to J. A. Brown, welding foreman of Moore Dry Dock Co. at Oakland, Calif., in *Moorship Mariner*. A discarded two-inch stub from a 14-inch rod means about 14 percent waste.

When a rod is used down to a minimum stub, the welder grounds the next rod and caps it with the stub in the holder. About three seconds are required for this weld to cool and then the welding job can be resumed.

Addition of a cap permits use of the entire coated surface of the next rod. Capped rods not only conserve material but they permit of welding in hard-to-get-at places because the cap may be applied at an angle.

•

Power Supply for Irrigation

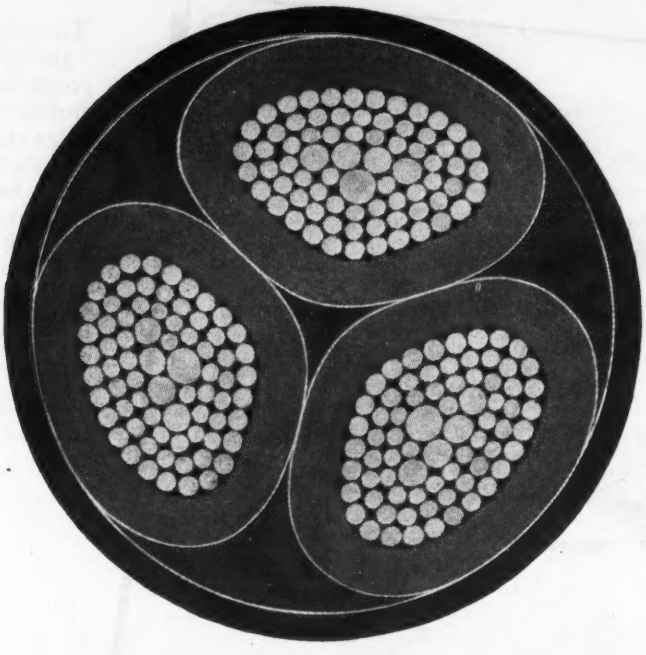
By CLARK J. WELLS
Electrical Engineer
U. S. Department of Interior
Coolidge, Arizona

TEN years of satisfactory experience with irrigation-power transformer banks like this; disconnect switches are located on adjoining pole

Simplicity and economy of material are features of the transformer and auxiliary equipment installations for furnishing power to irrigation pump motors. There are approximately 100 such pumps with motor sizes ranging from 40 to 150 horsepower in one territory.

There are no buses on the 12,000 volt side where the risers extend from the transformers to the Kelman oil breaker. The 460-volt leads are bused on the transformer bushings, then taken to the motor control cabinet through conduit. With steel scarce, wooden beams could be used for the main supporting members. However, steel presents less fire hazard, since wood soon becomes soaked with oil.

In an earthquake region it would be advisable to provide better support for the transformers.



"Specifications Alone are Not Enough"

Specifications under which your paper insulated cables are made are important because such cables usually carry large blocks of power to vital distribution centers. Specifications alone are not enough because careful preparation and skillful assembly also are necessary if best results are to be attained.

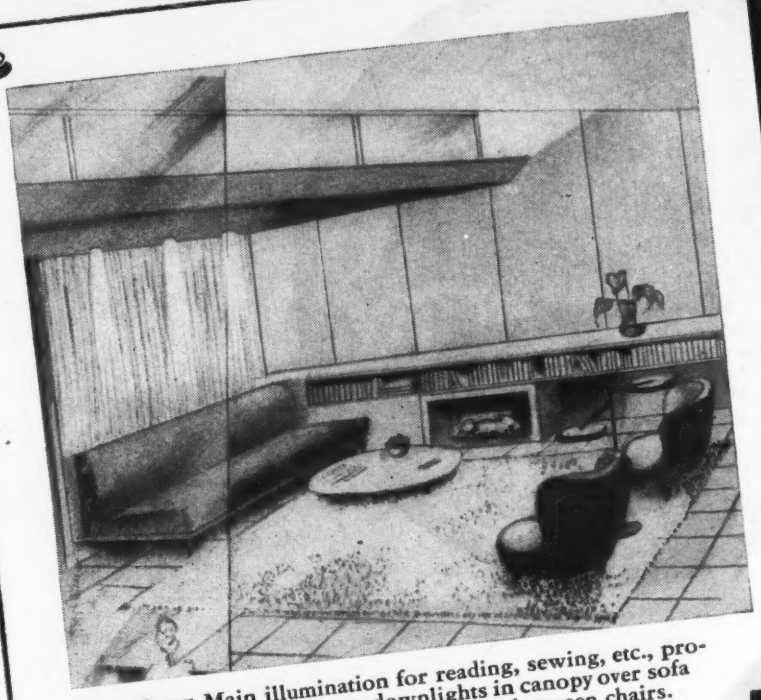
In the manufacture of Simplex paper insulated cables great care is used in selecting impregnating oil, insulating paper and other materials. The oil is thoroughly degassified before being used and the paper is vacuum dried and freed from air before being impregnated.

To help you get paper insulated cables to carry out your post-war plans most efficiently we offer you the benefit of our long experience in making paper cables, supervision by skilled cable engineers, careful workmanship, and efficient equipment.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex

WIRES and CABLES

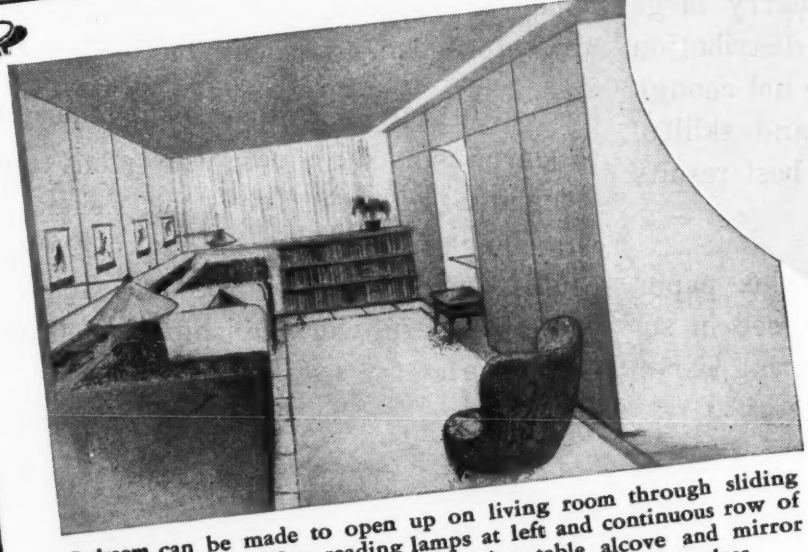


Living Room Main illumination for reading, sewing, etc., provided by R-40 reflector lamp downlights in canopy over sofa and by circular fluorescent portable lamp between chairs. Continuous—row fluorescent in front edge of canopy and behind sofa for added light and decorative effect.

To help you build your postwar lighting markets, General Electric has commissioned 17 leading architects and designers to create new lighting ideas and fixture suggestions for postwar stores, offices and homes. Cooperating fixture manufacturers are planning fixtures around many of the new lighting ideas developed through this G-E program.

On these pages General Electric illustrates some of the modern lighting effects that Designer G. McStay Jackson of Chicago believes are appropriate for postwar homes of modest size and price. Mr. Jackson's concepts

THERE'S NO *this* .. But G-E's Dramatic New



Bedroom can be made to open up on living room through sliding wall arrangement. Note reading lamps at left and continuous row of fluorescent in ceiling at right. Dressing-table alcove and mirror (right center) lighted by F lamps behind crystal diffusing glass.

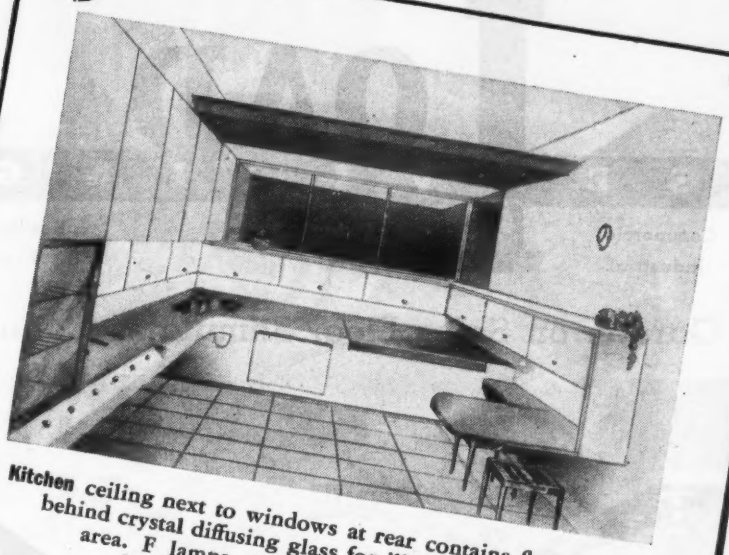
Keep Buying War Bonds— Keep the War Bonds You Buy

GENERAL ELECTRIC

represent lighting that is modern not only in form and imagination but also in levels of illumination.

Ideas like these will help you give the owners of new postwar homes the highest standards of lighting they ever have known . . . and will influence the relighting of existing homes as well.

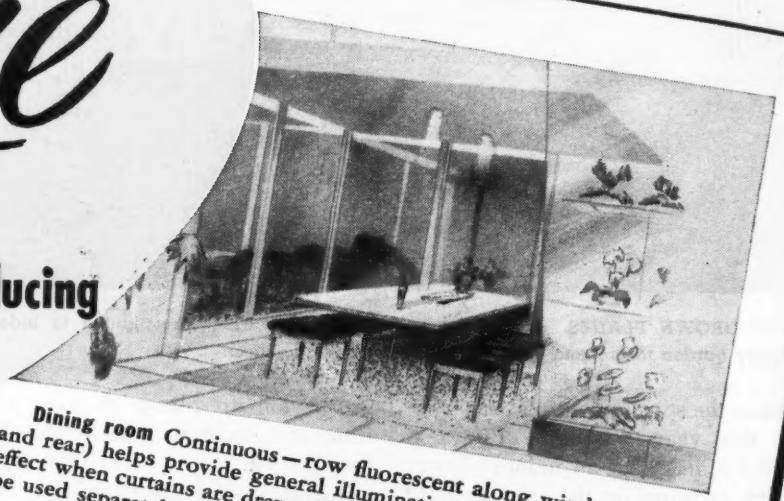
A complete brochure describing Mr. Jackson's suggestions now is being written. If you would like to receive a copy, write Div. 166-EW-130, General Electric Lamp Department, Nela Park, Cleveland, Ohio.



Kitchen ceiling next to windows at rear contains fluorescent behind crystal diffusing glass for illumination over work area. F lamps recessed in panel across center of kitchen provide indirect general lighting. Fluorescent lamps under cabinets at left and right.

PLACE LIKE *home*

Design Program is Producing Home Lighting Ideas!



Dining room Continuous—row fluorescent along windows (left and rear) helps provide general illumination and creates luminous effect when curtains are drawn. Filament downlights over table can be used separately or in combination with the fluorescent.

Hear the General Electric radio programs: "The G-E All-Girl Orchestra", Sunday 10 p.m. EWT, NBC; "The World Today" news, every weekday 6:45 p.m. EWT CBS.

"TO MAKE G-E LAMPS STAY BRIGHTER LONGER"
The Constant Aim of G-E LAMP RESEARCH

G-E MAZDA LAMPS

LOAD SERVICING

Commercial
Industrial

Residential
Rural

Garden on Sales Floor Stimulates Canning

WELL-GROWN PLANTS, some showing blossoms and fruit, transplanted to indoor victory garden to promote interest in coming canning season

Since the spring planting season began this year Wisconsin Power & Light Co. has kept an indoor victory garden growing on the sales floor of its Fond du Lac office hoping to inspire confidence in prospective gardeners and stimulate a healthy interest in the coming canning season. The plan seems to be working.

Vegetables for the garden were started in a greenhouse. Later standard greenhouse flats were transferred to the demonstration garden and edges covered with soil to produce a realistic garden effect. The 300-watt floodlights burning 12 hours daily, kept the vegetable plants growing normally for two to six weeks.

From April 12 to June 1 the garden showed 31 varieties of vegetables growing, with suggested planting dates for early, medium-early and late gardens. Starting June 1, well-grown tomato plants showing blossoms and small fruit were placed in the garden to foster interest in preparations for the canning season.

Earlier in the season, applications for victory garden plots were accepted at the garden by the company working in cooperation with this community enterprise. The company district office was also the County Victory Garden headquarters.

Aspiration of the Fond du Lac district is to excel last year's record when more than 850 women attended weekly canning demonstrations and Health for Victory canning meetings. Some 43 Fond du Lac women accepted the company's offer to allow use of the demonstration kitchen for their own canning and more than 1,000 pints of vegetables were canned under the direction of Thelma Bly, company home adviser.

A Post-War Program * Of Dealer Cooperation

The post-war merchandising program of the Public Service Co. of Indiana, Inc., Indianapolis, recently announced in a series of meetings with appliance dealers, embraces a 10-point dealer cooperation plan under which the company will leave the selling of refrigerators, ranges and other appliances to dealers. However, the company will advertise, promote and assist in every practical way the merchandising of equipment as will increase the sale of gas and electric service.

Details of the program, outlined in the recent series of meetings with dealers, follow:

1. Advertising

I. To create the desire for comforts, benefits and convenience of electric and gas appliances.

II. To build better customer acceptance and appreciation of the value of adequate electric and gas service.

III. To assist the dealer to sell more appliances.

Advertising Media to Be Used

a. Newspaper advertising.
b. Bill inserts and direct-by-mail.
c. Outdoor advertising.
d. Window displays.
e. Radio spots, where available.
f. Special seasonable campaign advertising.
g. Special customer publications.

2. Installment Sales

The company will arrange to make available to all qualified dealers, a finance plan of one of the nationally known commercial credit companies. This plan will provide for the collection of installment sales payments through the local offices of the company, of all sales of electric and gas appliances to our retail customers.

3. The Installation of Appliances

I. A flat-rate charge, depending on local conditions, to cover the cost of installing electric ranges, electric water heaters and automatic gas water heaters, will be established by the company.

II. Free installations of gas ranges and gas refrigerators, providing gas is piped to the kitchen.

Installation to be made by authorized electric contractors and plumbers.

In locations where it is impossible to work out satisfactory arrangements for the installation of appliances, the company will make such installations.

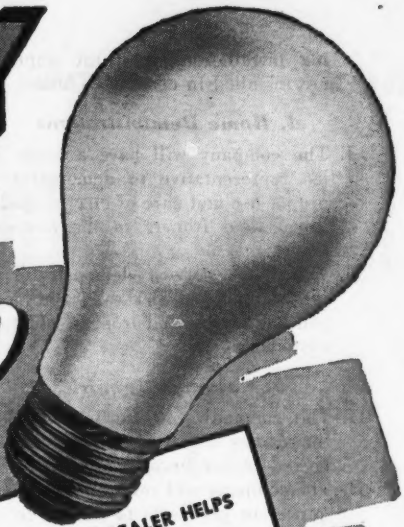
III. The company service men will inspect and make necessary adjustments of ranges, water heaters and home heat-

* From "Public Service News" employee house organ of Public Service Co. of Indiana, Inc., Indianapolis

VERD-A-RAY

SPONSORS SLOGAN CONTEST AS FALL PROMOTION

$5,000.00 IN PRIZES...



ALL NECESSARY DEALER HELPS —A COMPLETE NATIONAL ADVERTISING PLAN TO AND FOR JOBBER, DEALER AND CONSUMER. GET IN—**NOW!**

THESE ARE A FEW OF THE MAGAZINES WHICH WILL CARRY SPACE...

VERD-A-RAY CONTEST RULES

1st PRIZE.....	$1,000 in War Bonds
2nd PRIZE.....	750 in War Bonds
3rd PRIZE.....	500 in War Bonds
4th PRIZE.....	250 in War Bonds
NEXT 25 PRIZES.....	100 in War Bonds

1. Go to your dealer where entry form will be given to you free of charge or other obligation. Write 6-word (or less) slogan descriptive of VERD-A-RAY. Purchase and use of VERD-A-RAY might be of value in making you familiar with the product, but it is not a condition necessary to entering this contest. Your own facsimile of entry will suffice.

2. Mail your entry to VERD-A-RAY CORPORATION, Toledo 5, Ohio. All entries must be mailed not later than midnight, December 31, 1944.

3. Entries will be judged on the basis of originality of idea. Penmanship or fancy entries will not count extra. Decision of the judges will be final. In case of ties, duplicate prizes will be awarded.

4. No entries will be returned. All entries, ideas and contents thereof will become the property of VERD-A-RAY CORPORATION.

5. This contest is open to any resident of the United States except the employees (and their families) of VERD-A-RAY CORPORATION, or its affiliated companies, and is subject to Federal, State and Local laws and regulations.

Distributors' salesmen and dealers identified with prize winners also qualify for prizes.

● VERD-A-RAY is a new type of incandescent light bulb scientifically designed to make seeing easier. In comparison with the "pinkish" white light of ordinary frosted lamps, note the comforting "pastel greenish" white light emitted by VERD-A-RAY.

Scientific research data indicates improved visual (sharpness) acuity, relief from eyestrain and reduced glare.

Many war plants use VERD-A-RAY; one such plant reporting in a trade paper that hospital treated headaches were reduced 69.13%, hospital treated minor accidents were reduced 54%, and 357 productive man-hours were saved in one department in one month after proper installation of this new "glareless" lamp.

WRITE TODAY

VERD-A-RAY

CORPORATION

TOLEDO 5, OHIO

DISTRIBUTORS and DEALERS: VERD-A-RAY has field-tested prewar displays for our product in addition to complete display kits for the slogan contest.

ing installations after the appliances are installed in customer's home.

4. Home Demonstrations

I. The company will have a home service representative to demonstrate the proper use and care of electric and gas ranges and ironers in the customer's home.

II. The home service demonstrator will follow up all dealer sales for electric and gas ranges and ironers sold to our customers.

5. Customer Inquiries

I. The company will furnish the dealer the names of all new customers connected to our lines.

II. The company will refer all customer inquiries or prospects to dealers in rotation, unless a preference for a particular product is stated.

6. Model Homes

The company will advertise, furnish banners, signs and floodlights at builder's or contractor's request for any new home which conforms with adequate wiring standards and/or has complete electric or gas kitchen, or uses gas for home heating.

7. Auditoriums and Exhibits

I. The company will offer the use of its auditoriums or other facilities, where available, for meetings, demonstrations and exhibits.

II. The company will actively co-operate in promoting any public exhibits, shows or demonstrations of electric and gas appliances.

8. Sales Personnel

The company intends to have a supervisory sales personnel in our larger communities to actively co-operate with the dealer in the sale of electric and gas appliances.

In those towns in which we are actively engaged in selling gas for home heating, the company will provide heating engineers to assist our dealers in promoting the sale of gas heating equipment.

9. Appliance Servicing

It will be the company's policy to refer requests for appliance service to authorized dealers.

The company will continue to make adjustments to customers' appliances for the proper utilization of electric and gas service.

10. Sales Promotion

I. It will be the company's policy to devote its sales promotion efforts and advertising for the purpose of developing customer acceptance and building dealer sales of appliances. This will embrace a program featuring:
   a. Adequate wiring of the home.
   b. Better light and better sight activities.
   c. Commercial lighting program.
   d. All electric kitchens program.
   e. Gas for the four big jobs.

II. The company will maintain model kitchen displays, lighting exhibits and model home heating installations in its district offices.

III. The company will conduct cooking schools and lighting demonstrations in those towns where it has facilities available.

IV. The company will endeavor to form associations and have meetings with the dealers in its territory to further promote co-operative efforts in the sale of appliances.

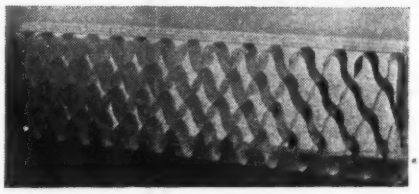
V. Seasonable sales activities will be promoted to tie in with local and national campaigns.

VI. All dealers will be furnished a folder showing territory served by the company; company electric and gas rate schedules, and complete information regarding company installation and servicing and dealer cooperative plan.

•

Fixtures Made of Colored Plastic

Fluorescent fixture design and application has, over a period of years, advanced due to discussion and experience. Several post-war fixtures designed by Morris Sanders, Industrial Plastic Design Advisor, Celanese Celluloid Corp., 180 Madison Ave., New York City were recently publicized to stimulate discussion and encourage lighting fixture manufacturers and architects to investigate the possibilities of new designs and new outlets. One of the several designed is shown in the accompanying illustration.



ONE OF THE several fixtures designed by Morris Sanders for the purpose of stimulating discussion and encouraging investigation of new designs and new outlets of fluorescent fixtures

The fixtures are made of Lumarith, a cellulosic plastic which can be colored producing shades that are particularly suited to the individual needs and products of department stores, restaurants, food shops, beauty shops, gasoline stations and waiting rooms, as well as living quarters such as kitchens, bathroom, bedroom, living room, etc.

To clean the fixtures they need only be "pinched" out of the frame, wiped with a damp cloth and returned to position. The transparent and translucent quality of the plastic eliminates shadows and conserves light.

Live Demonstration Develops Good Will

By KENNETH L. EDE

Advertising Manager
Ohio Public Service Co.
Cleveland, Ohio

Unique tie-up between the local utility and a local industry recently resulted in additional workers for the war plant and an enhanced good will among industrial customers and domestic customers for The Ohio Public Service Co. The utility's large show window at Alliance was turned into a miniature aircraft riveting school to help the Taylorcraft Aviation Corporation recruit workers.

Six charming girl riveters, working three to a shift, manned three brightly painted riveting benches, while a supervisor went from bench to bench examining the work and making suggestions for improvement. A fourth bench, equally brightly painted, was left unmanned and labelled "ABSENTEE" with another placard reading "Why don't YOU Occupy this Bench?"

Attracts Attention

The window attracted considerable attention, with a constant crowd in front of it watching the girl operators at their tasks. Necessarily they saw the "Wanted—Men and Women" signs, and the interesting display of parts which constituted part of the window display.

More than 100 persons made application for jobs, from which 62 satisfactory workers were accepted. In addition, the Alliance USES office reported that many other applicants came to their offices and were referred to other shops. These were not included in the count of those who went to Taylorcraft.

Canning Tied In

To take full advantage of the interest which the window created, a continuous canning demonstration was set up on the store floor during the same week. Mrs. Margaret Roller, O.P.S. Home Economist, conducted actual canning demonstrations in the bay along the traffic aisle of the store. In addition, a moving picture projector was set up, chairs provided for an audience, and a moving picture of 20-minute duration showing the recommended procedures for canning was run every hour, from 11:00 a.m. until closing time.

Hear and enjoy this brilliant new radio program

"THE ELECTRIC HOUR"

Starring

NELSON EDDY

WITH ROBERT ARMBRUSTER'S ORCHESTRA, GUEST STARS AND CHORUS

10:30 P.M., EASTERN WAR TIME
ENTIRE COLUMBIA NETWORK

• Twice voted radio's "Star of Stars," Nelson Eddy is also a screen and concert favorite with a wide following. His golden baritone, plus Robert Armbruster's 35-piece orchestra, plus a chorus and guest stars, all add up to a *popular* program packed with good music and good humor.

Woven into the entertainment are friendly, factual messages about America's *business*-managed light and power companies. They reach electric customers everywhere and will contribute to a clearer understanding of the industry's aims and accomplishments.

This grand new show extends and strengthens the continuing program of publication advertising in *The Saturday Evening Post, Collier's, Life, Time* and *Newsweek*, as well as business and farm magazines.

With an outstanding star and a talented supporting cast, "The Electric Hour" is one of the best shows on the air. Hear it yourself and ask your friends to listen. It deserves the support of the entire industry because it advances the interests of the entire industry.

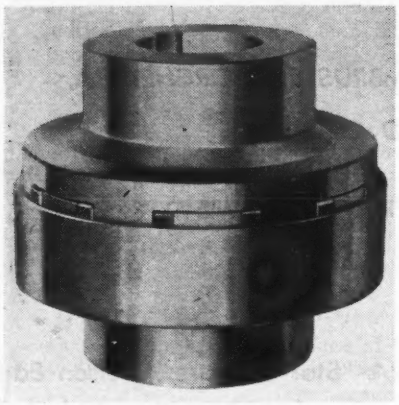
160 ELECTRIC LIGHT AND POWER COMPANIES*

SELF-SUPPORTING, TAX-PAYING BUSINESSES

★NAMES ON REQUEST FROM THIS MAGAZINE

NEW EQUIPMENT

Coupling



Type "C" shrouded flexible coupling; 4.6 to 806 hp. at 100 r.p.m.; no lubrication required; noiseless; **Lovejoy Flexible Coupling Co.**, 5009 West Lake St., Chicago 44, Ill.

Free floating load cushions between the jaws are held in position between an inside steel sleeve and the removable steel collar. Types are made for attaching to flywheels, also drum type for disassembly without disturbing drive or driven equipment. Useful for correction of misalignment, protection from shock and vibration, and other transmission troubles.

•

Finish

Mirac; porcelain enamel finish; fired at 1,500 deg. F.; **Pemco Corp.**, Baltimore, Md.

One coat white which is stated to require no special bond or pickling equipment. Reported to have good adherence qualities and can be fired at 1,500 deg. F. resulting in a highly opaque finish. Is stated to be applicable direct-to-the-steel.

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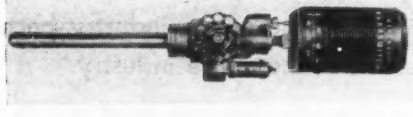
Compressor Control



Ashcroft Compressor-Trol; 3 sizes, ½ in., ¾ in. and 1¼ in.; **Manning, Maxwell & Moore, Inc.**, Bridgeport, Conn.

Instrument is said to combine seven devices for the control of compressor operations into one unit. Sizes are determined by inlet connection. Reported to cover requirements of tank mounted compressors up to 15 hp. Equipped with Duraswitch, with either electrical or mechanical attachment for operating the two-way unloading valve mounted on the Compressor-trol casting. Combined switch and gage has gearless movement, slide rule dial, self draining and non-freezing Bourdon tube. Gage is removable and replaceable in case of accidental damage.

•

Electrically Heated Tank

Plast-O-Dip Tank; insulated; dipping space 25-in. long, 13-in. wide, 12-in. deep; 110 or 220 v. a.c.; two 4.5 kw. heating elements. **Aeroil Burner Co., Inc.**, West New York, N. J.

An electrically heated tank for heating, melting and dipping of ethyl-cellulose compounds. Reported that uniform indirect heat is distributed around and within the tank without "hot spots". Two thermostats hold bath at desired temperature. It is reported that no "Mother Tank" is needed.

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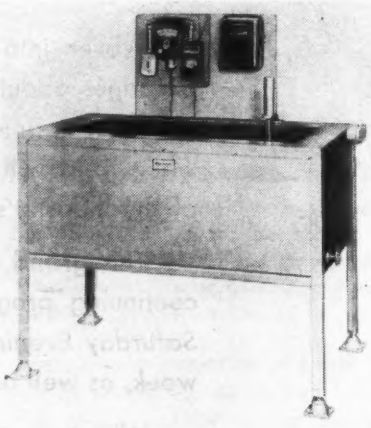
Wax Bath

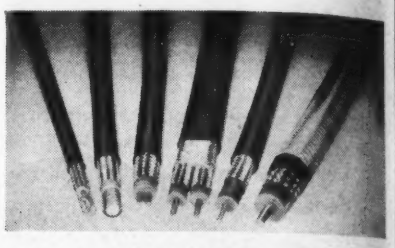


Wax dipping bath: temperature adjustable from 100 to 550 deg. F.; built to order in sizes for requirements of user. **Barnstead Still and Sterilizer Co.**, Forest Hills, Boston, Mass.

Electrically heated by low density type strap-on heating elements on bottom and four sides, bath is of welded steel plate construction. Bath temperature is automatically controlled by thermostats fitted with dial thermometers. Tank has Fiberglas insulation.

BUYING ELECTRICAL EQUIPMENT—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Ultra-High Frequency Cables



Types, coaxial, dual-coaxial, twin-conductor, coaxial air-spaced and spiral delay; 50 to 70 ohms impedance; **Federal Telephone and Radio Corp.**, 28 Halsey St., Newark 1, N. J.

New sizes and types of solid-dielectric coaxial cables used in ultra-high-frequency radio and radar equipment have been announced. Coaxial lines include sizes from 3/16-in. O.D. up to cables over one inch O.D. Standard designs include single and double-braid constructions with standard and armored covering. Dual-coaxial lines used for parallel circuits requiring a high degree of electrical balance. Twin-conductor lines as balanced shielded pairs. It is stated that coaxial air-spaced cables can be made in any length with capacitances as low as 8 micro-micro-farads per foot. Spiral delay lines for special test sets requiring lines with an appreciable delay or high impedances are available.

•

Insulating Tape

"Fibron" plastic tape: tensile strength 1,700 psi.; dielectric strength 1,000 v.p.m. (0.012 in.); power factor and dielectric constant at 30 deg. C. and 60 cycles, 6.5 and 7.6 percent, respectively; low temperature flexibility, minus 40 deg. C.; bonding temperature, approximately 150 deg. C. **Irvington Varnish and Insulator Co.**, 6 Argyle Terrace, Irvington 11, N. J.

Manufactured from Vinylite resin, and said to be heat-sealing and flame resistant, the tape is suitable for insulating wires, splicing cables, and protecting wiring, piping and equipment exposed to caustic or corrosive fumes, oil, grease, acids, alkalis or moisture.

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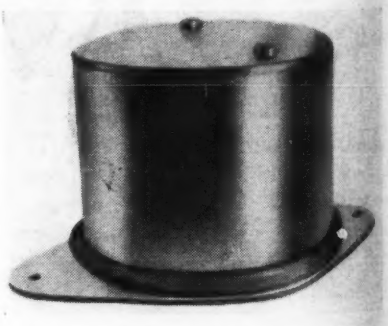
Time Delay Relay



Type TD-4; **R. W. Cramer Co. Inc.**, Centerbrook, Conn.

Time delay relay for surface mounting with automatic reset on power failure. Is reported to have special overtravel mechanism which relays recycling in case of momentary power interruption. Said to have moistureproof case. Is used for controlling the closing of plate circuits as in radio transmitters or rectifiers.

"Making Big Ones out of Little Ones"

No. 7753

Hubbard Sleeve-Nut Pole Reinforcing Bands for Stubbing Poles

With most of our lumbermen handling knives and walnut gun stocks instead of axes and cedar, pole replacements are somewhat of a problem in many localities. Add to this, the difficulties of shipping and handling heavy materials amidst war time traffic congestion and the result is a scarcity of poles for some of our Utility Companies.

The problem is being partially solved on a temporary basis by pole stubbing. Discarded poles with rotted bottoms but firm wood above the original ground line are used as stubs. After cutting away the rotted butt and treating, stubs are set alongside the pole which is in service but in need of replacement. Hubbard Sleeve-Nut Bands are installed as shown in the diagrams.

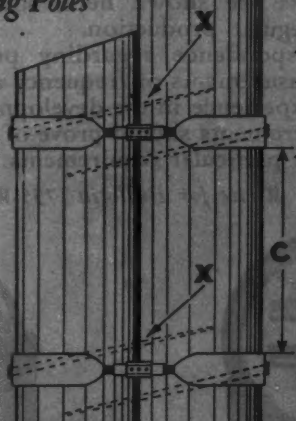
Given a solid setting for the stub, the resultant structure will hold to the breaking strength of the average pole, as illustrated by the accompanying photo of a test.

Stubbing "Across the Line"

(A)

Stubbing "On the Line"

(B)



Diagrams above show the usual methods of stubbing which are (A) "across the line" and (B) the alternative method, "on the line". Dowels (X) may be used in either case but are especially recommended for "on the line" installations. Separation of bands (C) is 36" to 50" depending on potential line strain and pole height.

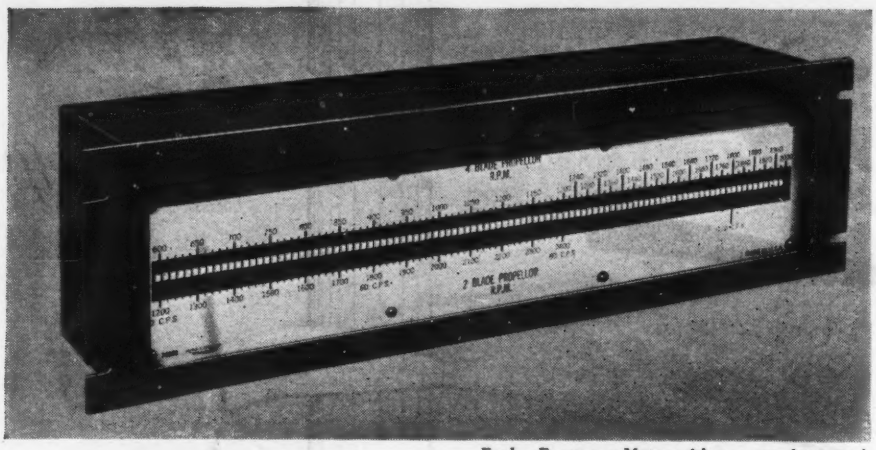
Testing a Stubbing Band Assembly

Above pole broke at 48,000 foot pounds without damage to the Hubbard Sleeve-Nut Stubbing Band. Pull was applied "in line" with conductors, stubbing was "across the line". Dowels were used.

HUBBARD AND COMPANY

PITTSBURGH · OAKLAND · CALIFORNIA · CHICAGO

"FRAHM" *Resonant Reed* INSTRUMENTS



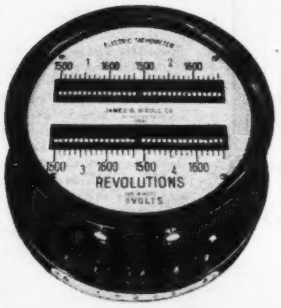
Frahm Frequency Meter with one row of 101 reeds. A recent development for a government agency.

NEW MODELS ... *New Applications*

The resonant reed principle as applied to the measurement of speed, frequency and rates of vibration, first introduced in this country by Mr. James G. Biddle in 1910, has been widely adopted for a variety of services. During recent years, we have been called upon to develop units for special applications far removed from the original simple measurements of speed and frequency. Some of these special purpose instruments are shown here; some have already been standardized for regular production.

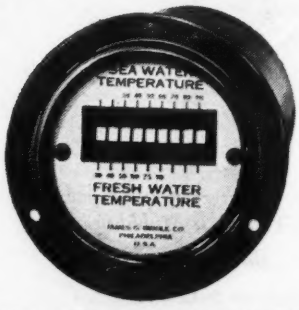
We invite correspondence regarding problems that may be solved through measurements of frequency and rates of vibration. Our accumulated experience in the development and use of Frahm Resonant Reed Instruments should prove of value in suggesting an application for your particular requirements.

Write for Bulletin 1755-W.

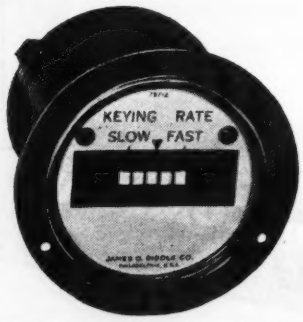


Frahm Electric Tachometer. 4 groups of reeds in the same range to aid in synchronization of the speeds of 4 engines.

Frahm Portable Frequency Meter for "series" operation in testing a special telegraph circuit.



Frahm Frequency Meter for determining temperature of salt and fresh water.



Frahm Frequency Meter for use in a special electronic circuit. Used in a device for geodetic surveying.

JAMES G. BIDDLE CO. 1211-13 ARCH STREET PHILADELPHIA 7, PA.

TECHNICAL LITERATURE

Mica Capacitors — Publication describes mica capacitors built to joint Army-Navy specification Jan. C-5 of April 20, 1944. Charts and drawings are large enough so that legends are clear and legible. All tables are simplified. Specifications cited are complete. Copies of this bound catalog 12 section J-1 which contain the above are available to the radio and communications industries from Solar Manufacturing Corp., 285 Madison Ave., New York 17, N. Y.

Pumps—Bulletin No. 447 published by the Chain Belt Co., 1600 W. Bruce St., Milwaukee 4, Wis. contains data and examples on "How to Figure the Right Pump for the Job." Also included are the following: (1) Table of water friction in 100 ft. of pipe, (2) Practical suction lifts for various altitudes and (3) Pressure Conversion Tables.

Turbine Cleaning Manual—A 16 page booklet published by the Shell Oil Co., 50 W. 50th St., New York 20, N. Y. Procedure explained is the result of experience gained in cleaning both stationary and marine lubricating oil systems, and it sets forth techniques to be followed both new and old installations.

"Nitrocellulose" is a 56-page book containing numerous tables, graphs and other pertinent information on properties, types, solubility, viscosity, and application in lacquers, coated textiles, plastics, adhesives and inks. The publication is obtainable from Cellulose Products Department, Hercules Powder Co., Wilmington 99, Del.

Steel Flooring—Detailed construction particulars, drawings, installation data and illustrations on uses of riveted and welded types of open steel grating and stair treads are contained in a 24-page publication issued by Wm. F. Klemp Co., 6601 South Melvina Ave., Chicago 38, Ill.

Safety Valves—Information Bulletin 501-A contains data on service limits, connections and other data for various sizes of iron, steel and bronze pop safety valves. This publication available from J. E. Lonergan Co., Second and Race St., Philadelphia 6, Pa., is the company's interpretation of the Safety Valve Standards developed under WPB and National Bureau of Standards auspices.

Contact Materials — Physical properties, selector chart, specifications and assembly methods for rivet, screw, disc and segment type of contacts, also notes on contact engineering design, are presented in a 32-page booklet entitled "Electrical Contacts" available from Fansteel Metallurgical Corp., North Chicago, Ill.

Welding Chart—A wall chart used to convey information from designers to workman. The graphical language of the welding industry is illustrated separately for fusion welding, resistance welding and for those requiring both types of welding. Twenty-three typical welded joints and sections, covering butt, lap, tie, corner and edge welds, are illustrated and marked with the standard welding symbols applying to that particular joint or section. Obtainable from Hobart Brothers Co., Hobart Square, Troy 1, O.

Lightning Arresters (for A.C. power circuits). ASA C62.1-1944; A.I.E.E., No. 28, May-1944. Revision (approved April 28, 1944) of American Standards for Lightning Arrestors first approved in 1936. New definitions for wave front, wave tail and wave shape. Techniques of measurement in impulse testing improved. Price 30 cents. American Standards Association, 29 West 39th Street, New York 18, N. Y.

Here's Why

Wagner

POLE-TYPE DISTRIBUTION TRANSFORMERS

Assure users of the utmost convenience and economy of operation

1 Core and Coils of improved design and construction with high-quality materials give high efficiency and low operating costs.

2 Diagram nameplate gives full information. Nameplate pad extends below nameplate to provide space for attaching users' data.

3 Support lugs of heavy bar-iron electrically welded to the tank are designed for direct-pole mounting. Upper lugs are provided with two jump proof lips. When crossarm mounting is desired, T-crossarm hanger-irons can be bolted to these brackets.

4 High voltage pocket-stud-type bushings of wet-process porcelain are co-ordinated with the winding insulation of the transformers so that line surges will flash over the bushings on the outside of the tank. Clamp-type connector gives ease of connection. The porcelain bell extending over the connector provides added safety. High- and low-voltage bushings are securely clamped in position by a keeper-plate and spring.

5 Pocket is made of copper-bearing sheet-steel electrically welded to the tank.

6 Rotary-type ratio-adjuster dial extends above the oil level. A pointer clearly indicates the ratio connected.

7 Domed cover of extra-heavy, press-formed, copper-bearing steel.

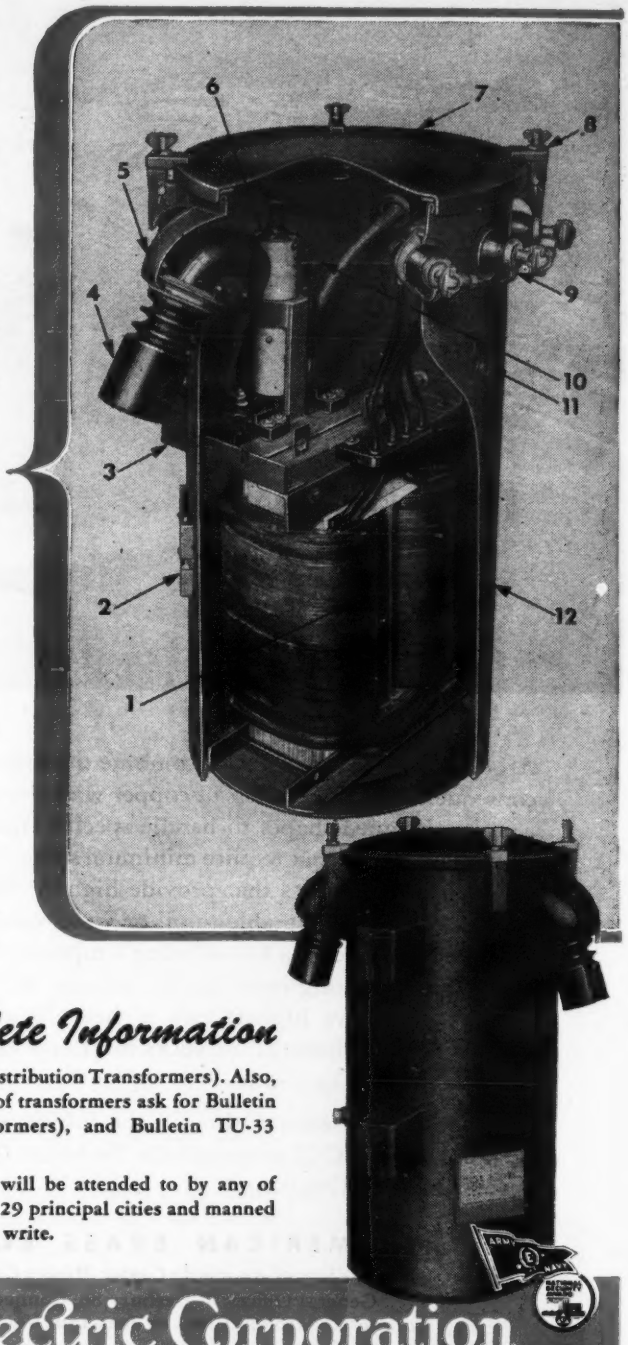
8 Cover clamping-assembly consists of a hot-galvanized wing-nut, bolt and clamp. The lower portions of the cover-clamps also serve as lifting-lugs on sizes 1½ to 10 kva.

9 Individual low-voltage stud-bushings of wet-process porcelain are properly coordinated with the winding insulation of the transformer. These bushings are of the removable type and are provided with solderless connectors.

10 Oil level clearly indicated.

11 Tapped pad suitable for attachment of solderless connector for grounding low-voltage neutral or for grounding of tank.

12 Tank is made of copper-bearing sheet-steel. Bottom is recessed to provide maximum protection while handling. Upper edge is rolled for added strength and to provide wide cover-gasket seat.



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are but one of several
WAGNER PRODUCTS

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INDUSTRIAL BRAKES
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INDUSTRIAL BRAKE CONTROLS
•
TACHOGRAPH
(Recording Speedometer)
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ELECTRIC MOTORS

744-15

Write for Complete Information

Ask for Bulletin TU-51 (Wagner Distribution Transformers). Also, if you are interested in other types of transformers ask for Bulletin TU-181 (Wagner Power Transformers), and Bulletin TU-33 (Wagner Noflamol Transformers).

Needs for immediate information will be attended to by any of Wagner's branch offices, located in 29 principal cities and manned by trained field engineers. Wire or write.

Wagner Electric Corporation

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ELECTRICAL AND AUTOMOTIVE PRODUCTS

Anaconda BUS CONDUCTORS
Super Highways for Electrical Power

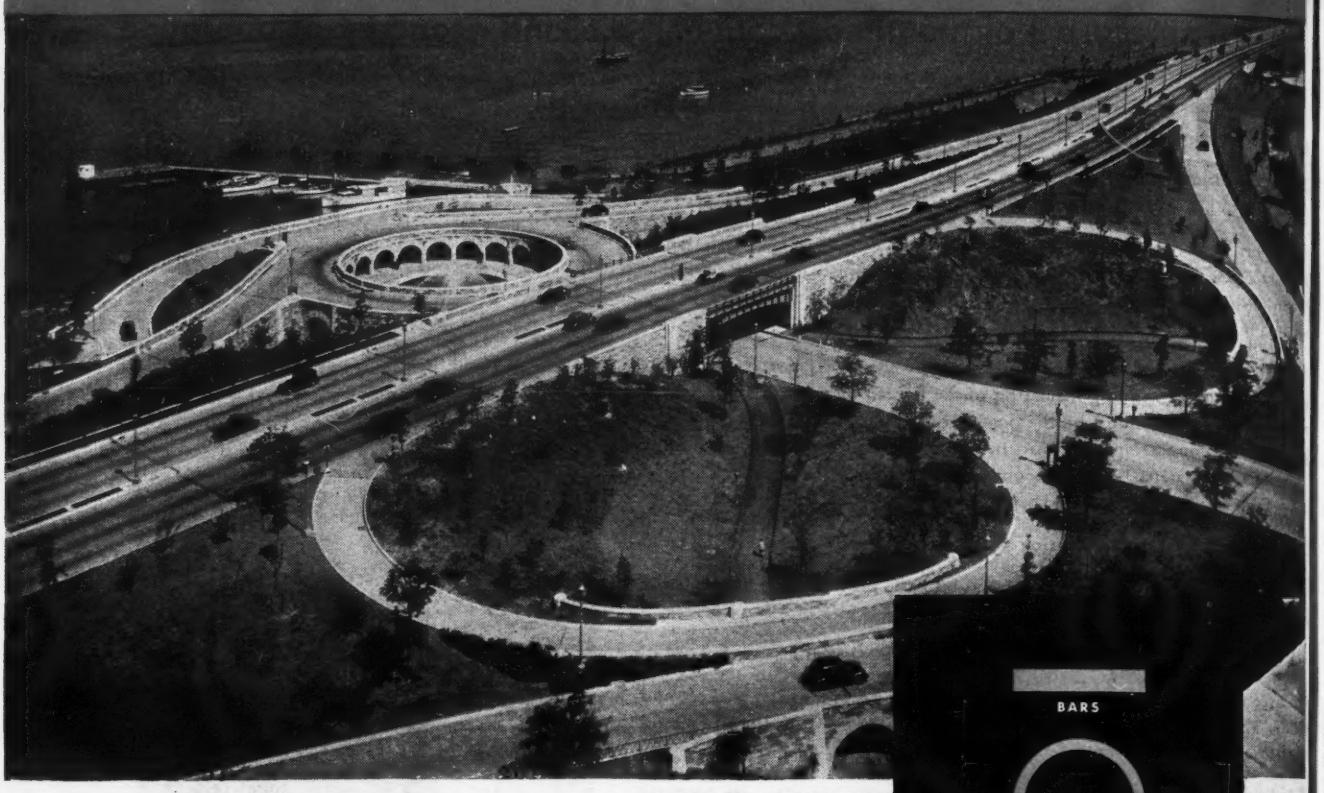
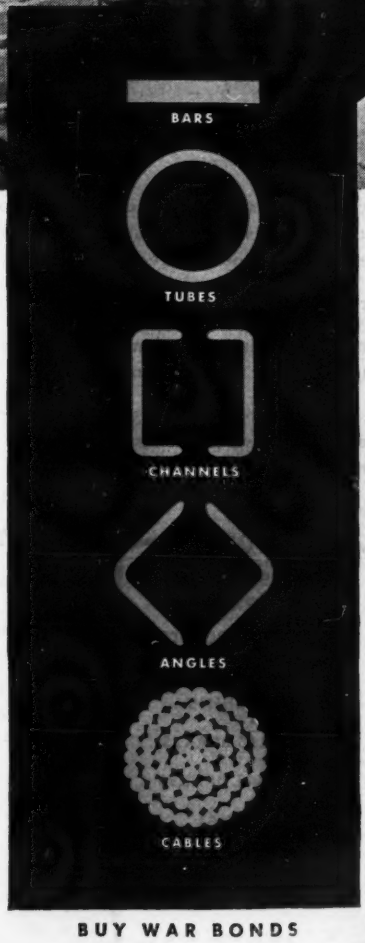


PHOTO BY EWING GALLOWAY



ANACONDA BUS CONDUCTORS combine the high conductivity and consequent low current loss of copper with the efficiency of scientifically designed shapes to handle specific transmission requirements: FLAT BARS that require minimum space and connect readily to apparatus . . . TUBES that provide highest efficiency at a.c. frequencies and are adaptable to oil or water cooling . . . CHANNELS with large surface area for reducing temperature rise, and providing rigidity for long runs and flat surfaces for tap-offs . . . ANGLE SQUARES that give highest rate of heat dissipation and handle greater current density . . . CABLES for heavy currents in limited space or moving apparatus.

For additional information on the subject of bus conductors, send for Booklet C-25 or consult the Technical Department of The American Brass Company. 44216

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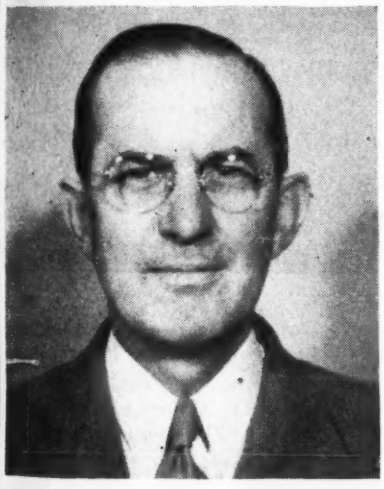
The victory you depend on depends on you.

NEWS ABOUT PEOPLE

Illinois Utility Makes Executive Appointments

J. W. Kehoe, northern division vice-president of Public Service Co. of Northern Illinois, was recently named director of public relations and service for the company. G. S. Bartlett, division operating superintendent succeeded Mr. Kehoe as division vice-president.

Mr. Kehoe will make his headquarters in the Chicago general office of the company and will direct the administration of community and company relations and customer services throughout the territory. He began his utility career in the meter department of a predecessor company, the North Shore Electric Co., in 1909 and with the exception of service in the army during



J. W. Kehoe

World War I, has been with the company ever since. In 1923 he was made assistant secretary and assistant treasurer with headquarters in Chicago. In 1926 becoming secretary in addition to his duties as assistant treasurer. He went to the northern division in 1928 as Evanston district manager, remaining five years before becoming division manager and then division vice-president in 1931.

Mr. Bartlett has served in the company's northern division since 1926 as division operating superintendent and

G. S. Bartlett

since 1943 as assistant to Mr. Kehoe. He began his association with the company as an inspector in 1919, subsequently serving as district engineer from 1921 to 1923 and then in Evanston as chief clerk. From 1923 to 1925 Mr. Bartlett was in the engineering department at the Chicago general office and in 1925 was made district manager at Pontiac.

•

▶ LAWRENCE W. CANNON of Michigan City, Ind., has been appointed a member of the Indiana Public Service Commission to succeed Hugh W. Abbett of Indianapolis who was recently appointed chairman of the commission. Mr. Cannon was formerly director of the motor vehicle department of the commission.

▶ JOHN W. YOUNG, since 1931 executive assistant to the vice-president, New England Power System, has been appointed lighting engineer, reporting to E. W. Dillard, electrical engineer. Following graduation from Washburn College, Topeka, Kan., Mr. Young spent 21 months overseas with the U. S. Army Engineers in World War I. He then attended the University of Pittsburgh, and for a time was connected with the Duquesne Light Co., of that city. In 1928 he joined the New England Power System, and for about two years was in charge of the southern district engineer's office at Providence, R. I. In 1931 he was appointed assistant distribution engineer with headquarters at Boston, and a few months later became executive assistant.

▶ WILLIAM H. LEONARD, vice-president and manager of the Milford (Mass.) Electric Light & Power Co., since 1913, retired from active service on Sept. 1. Mr. Leonard was born at Spencer, Mass., and became assistant to the superintendent of the former Milford Gas Light Co. in 1905. That utility became affiliated with the local power company in 1911. Through his long term of service Mr. Leonard has been active in promotional work and public relations. The company has been affiliated with the New England Power System for some years. LOUIS A. FIORANI, since 1934 merchandising manager for the New England Power System, Boston, has been named assistant district manager at Milford, as announced in ELECTRICAL WORLD, Aug. 12, page 16.

•

T. D. Reimers Joins Staff of Sheldon Service

Theodore D. Reimers, electrical superintendent of the Hudson Avenue generating station of the Consolidated Edison Co. of New York, has recently joined the organization of Sheldon Service Corp., manufacturers of electrical connectors, Long Island City, N. Y., in the capacity of engineering manager.

Following graduation from Cornell University in 1927, Mr. Reimers started working in the test bureau of Consoli-

Blank & Stoller

dated Edison Co. In 1928 he was transferred to the electrical engineering department. During 1936 he became division engineer of the distribution ap-

paratus division. At the beginning of 1941 he was made division engineer of the distribution planning division. His appointment to the Hudson Avenue station followed in 1943.

•

▶ DR. WILLIAM BLUM, chief of the section of electrochemistry, U. S. Bureau of Standards, has been made the recipient of the eighth Edward Goodrich Acheson Medal and Thousand Dollar Prize of The Electrochemical Society. Dr. Blum has made outstanding contributions to the standardization of electroplating methods and of plating formulas. He has been with the Bureau since 1909. The formal presentation of the award will take place at the fall convention of the society at Buffalo, N. Y., on October 13.

•

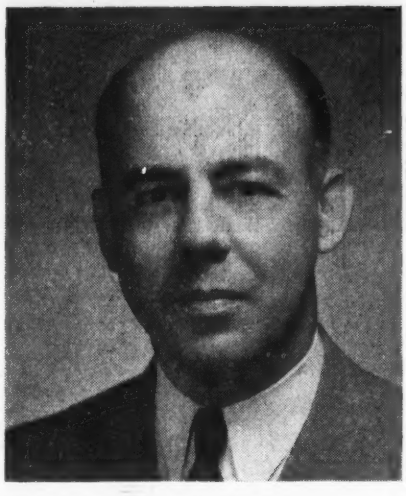
E. D. Almy Named Manager of Crocker Wheeler Div.

Capt. E. D. Almy, USN (retired) recently was appointed manager of the Crocker-Wheeler Electric Manufacturing division of Joshua Hendy Iron Works, Ampere, N. J., by Charles E. Moore, president of the company. Capt. Almy, who was assistant general manager of the company in the headquarters office at Sunnyvale, Calif., replaces A. J. M. Baker, who has resigned, effective Sept. 30, to become executive vice-president and general manager of the E. W. Bliss Co., New York.

•

Hotpoint Names Schafer General Sales Manager

Ward R. Schafer has been appointed general sales manager, Edison General Electric Appliance Co., Chicago. Now regional sales manager of the company's western region at San Francisco, Mr. Schafer has been a sales and engineering executive in Hotpoint's organization for almost 20 years.



He joined the company in 1924 as an engineer in commercial cooking sales. Later he was manager of product service for several years, and at the time war production halted sales, he was manager of the range sales division. Mr. Schafer was given a leave of absence in 1942 to join George A. Fuller company as superintendent of construction on a $30,000,000 butadiene plant at Houston, Tex. He rejoined Hotpoint last April.

•

▶ KIMBALL VANCE, owner and manager of Vance Electric Co., Salt Lake City, has been elected president of the Electrical League of Utah, succeeding F. E. Bodine, who has assumed new duties on the Pacific Coast (ELECTRICAL WORLD, Sept. 2, 1944, page 128).

▶ R. J. RUSSELL, vice-president and secretary of the Century Electric Co., St. Louis, Mo., has been appointed to the committee on federal finance of the U. S. Chamber of Commerce. Mr. Russell is a member of the Chamber's board of directors.

▶ WILLIAM J. MCBREARTY, senior trial attorney of the Detroit Department of Street Railways, has been appointed to membership on the Michigan Public Service Commission, to succeed the late Patrick H. Kane, of Port Huron, for a term ending Feb. 15, 1947.

▶ L. B. LEVESCONTE joins the staff of the Illinois Institute of Technology on November 1 as assistant professor of electrical engineering and chief engineer of the network calculator laboratory. Mr. LeVesconte has been employed by the Westinghouse Electric & Manufacturing Co. since 1926 in the switchgear division, the relay division and the central station division of the Chicago office. At the Illinois Institute of Technology he will be in charge of the network calculator to be installed in November by sixteen electric utility and manufacturing companies of the Middle West who are cooperating with Illinois Tech in the project.

•

Crouch Appointed I.E.S. Technical Secretary

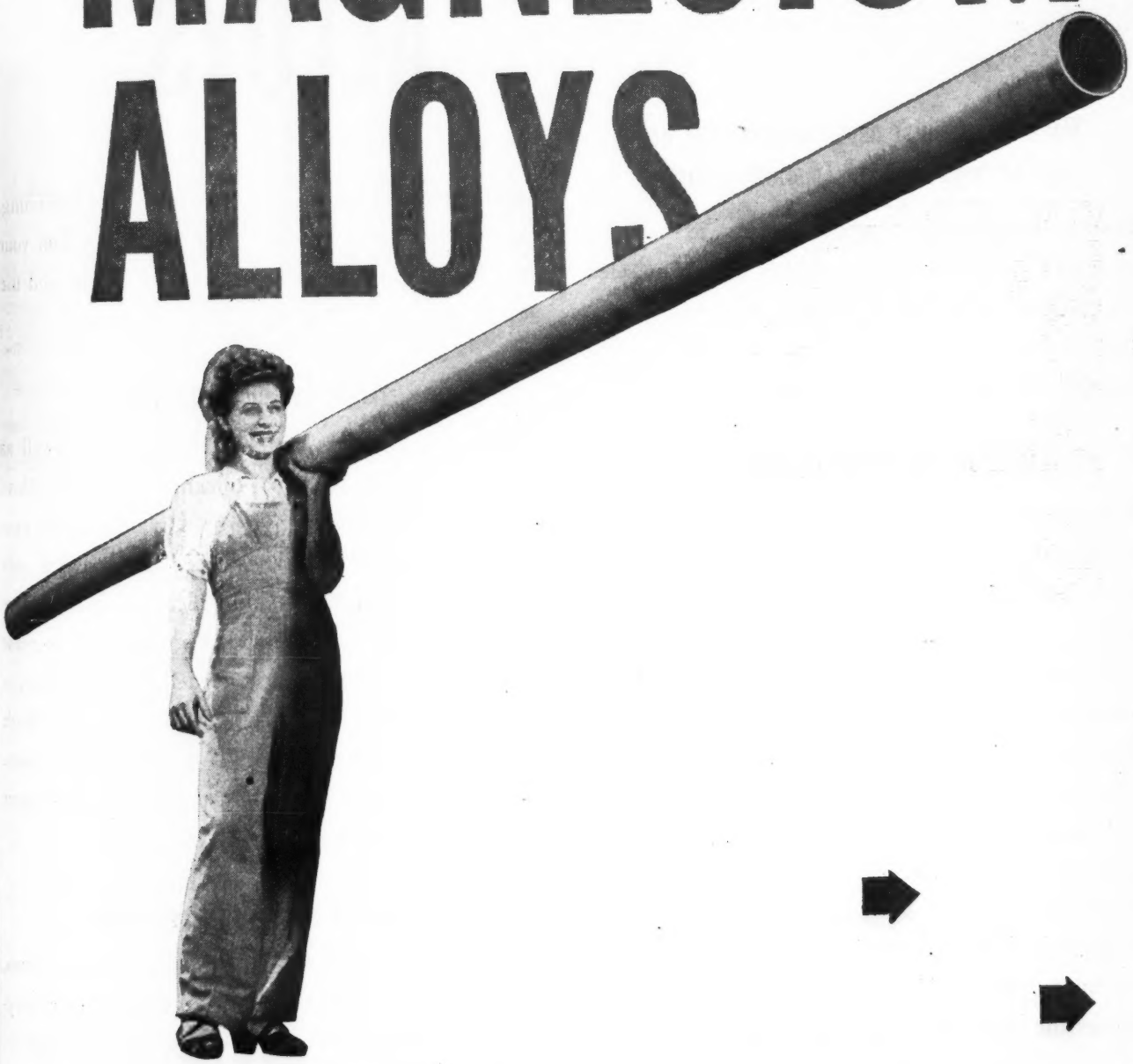
At the recent annual meeting of the Illuminating Engineering Society in Chicago, announcement was made of the appointment of Cazamer L. Crouch, illuminating engineer, as full-time technical secretary of the Society. Mr. Crouch's appointment is a step in the expansion of the activities of the Society's technical and research programs.

A graduate of the University of Michigan, Mr. Crouch studied illumination under Prof. H. H. Higbie, one of the early and most eminent scientists in the field of illumination. He spent two years in engineering design and application with the Holophane Co. and for five years was illuminating engineer for Wipperman Mitchell, Inc., electrical engineers and contractors in Buffalo, N. Y. Since 1935, when he joined the Buffalo Niagara Electric Co. as industrial lighting and special application engineer, Mr. Crouch's efforts have been directed almost entirely to study and research in special lighting problems. Early in the war, and until his present assignment, Mr. Crouch served in the Bureau of Ships, U. S. Navy, as an engineering consultant on special problems of secret classification.

Bachrach

As technical secretary, Mr. Crouch will act as a consultant to the technical committees and to the Council of the Illuminating Engineering Society. He will also be available for assistance in

REVERE MAGNESIUM ALLOYS



Lightening the burden of weight on men and machines . . .

REVERE MAGNESIUM ALLOYS

EVERY pound of Magnesium Alloy substituted for other metals will save weight. In the case of steel, the saving with equal thickness is 77% and with Aluminum Alloy it is 37%.

Magnesium wing tips, floor beams, oil and fuel tanks, seats, engine parts, wheels, housings, fairings, panels and many other parts have effected tremendous savings in the weight of modern aircraft. The result is greatly increased capacity in speed, range and payload.

War's spectacular uses introduce the new age of magnesium to American Industry

Mass in motion requires power—to start, to maintain, to stop. Power is expensive whether it is steam, electricity, gasoline or man's muscles. Magnesium alloy pattern plates in a foundry, are reported to have reduced one man's lifting by 4500 pounds a day.

Consider the Weight-Power Ratio

Power varies directly with mass or weight. Disregarding friction, a magnesium unit requires less than one-fourth as much energy to overcome inertia as a steel unit of the same dimensions.

The favorable weight-strength and weight-stiffness ratios mean that very little, and sometimes none of this power saving need be sacrificed when magnesium alloys are substituted.

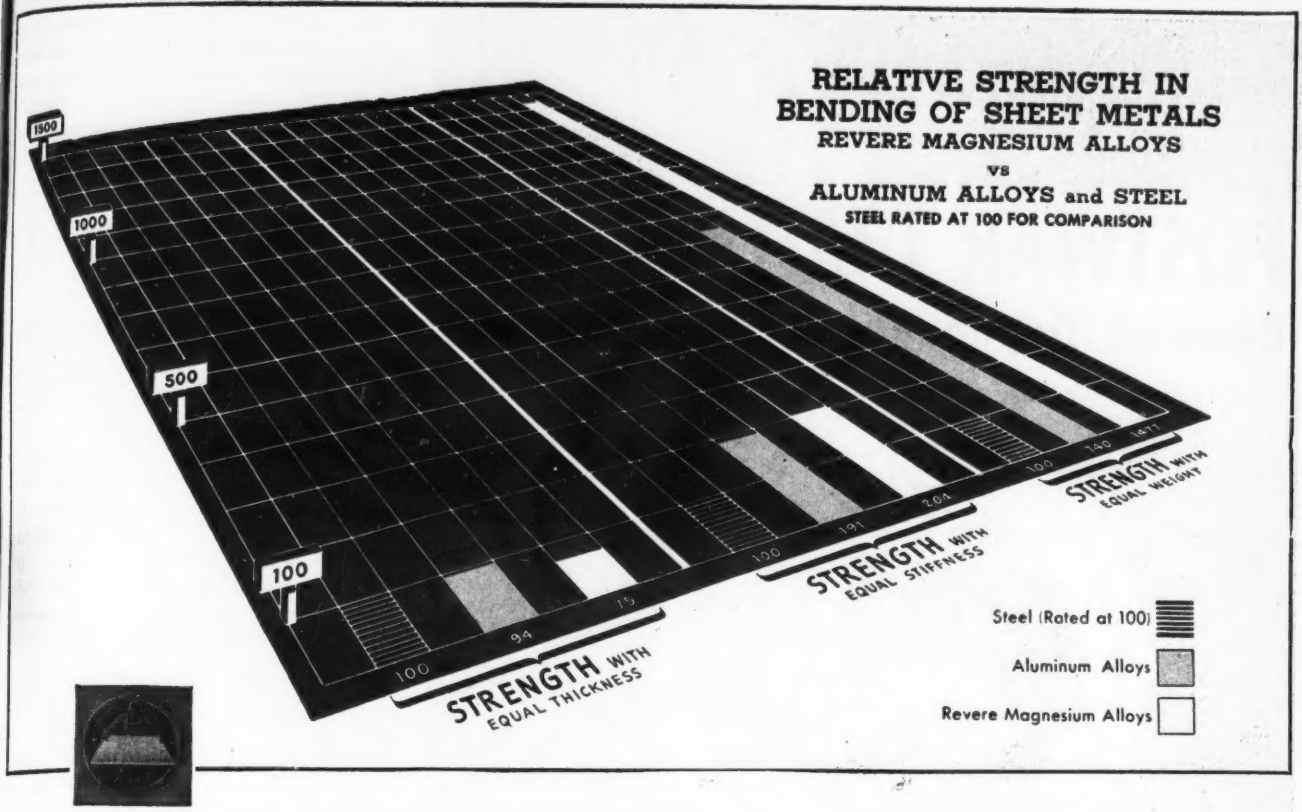
A pound of magnesium contains about 15½ cubic inches—a pound of steel 3½ and aluminum 10 cubic inches. On a pound for pound basis, you get 4½ magnesium units for one of steel and 1½ to one for aluminum. Magnesium goes further, and the further it goes the more you save. Remember that weight-saving means money-saving from the very beginning, in transportation and handling to and within your factory, in production processes, and in the end use of the product.

Lightness plus strength

Revere Magnesium Alloys offer strength as well as weight saving. With equal thickness, the sheet alloys have 75% of steel's strength in bending. To gain equal strength, the thickness need be increased only 15%, since strength in bending increases as the square of the thickness. To gain equal stiffness, an increase of only 65% in thickness is needed, since stiffness in bending increases as the cube of the thickness. With equal stiffness, the strength is double that of steel. With equal weight, bending strength is over 14 times that of steel. See the Chart.

Where to save with Magnesium

Transportation. Railroad cars, buses, trucks, trailers, aircraft. Will make it possible to haul heavier payloads in states limiting total weight on the road.



Hand-Operated Items. Anything pushed, pulled, lifted, carried. Vacuum cleaners and other household appliances; baby carriages; hand and portable tools; typewriters; instrument cases; luggage; hand trucks and dollies; mailing containers.

Reciprocating Parts. Anything that must be started, stopped, reversed in motion. Light weight and rigidity save power, reduce vibration.

Mill Products Available

Revere magnesium facilities are among the largest in the world. They offer sheet and plate, rod and bar, tube, extruded shapes, forgings and forging stock, in four different alloys.

May We Assist You?

The Revere Technical Advisory Service is at your command, ready to help you take full advantage of the remarkable qualities of Revere Magnesium Alloys. Let us show you how to use them to modernize and improve your own product, how production can be speeded up by increasing machining speeds, how to form, weld and rivet, simply, economically.

Write for your complimentary copy of the *new* 32-page booklet, "Revere Magnesium Alloys and the Light Metals Era," now coming off the presses. Presents the basic facts about magnesium, plus detailed technical data on the physical, mechanical and working characteristics of the Revere Alloys.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

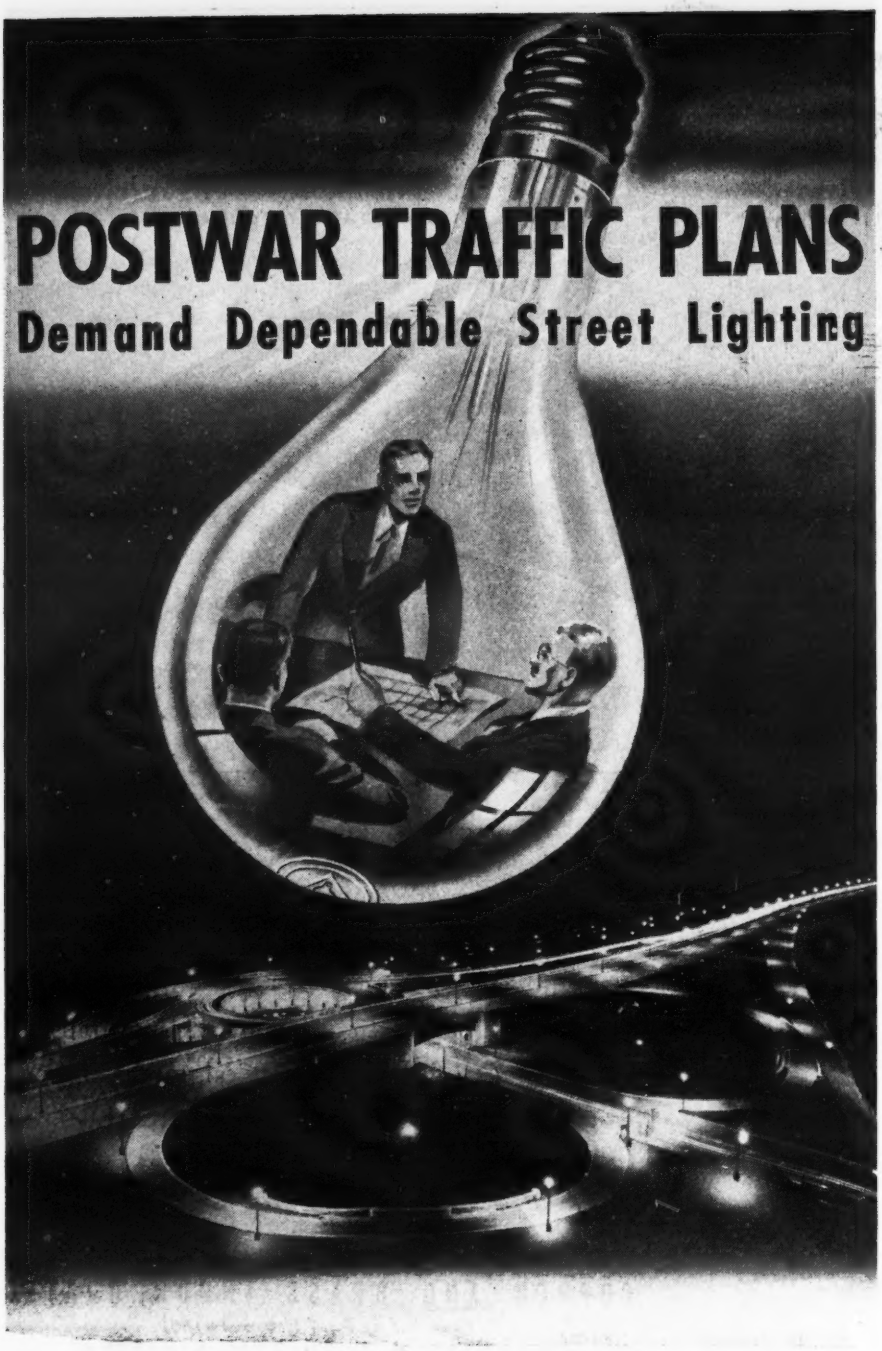
MAGNESIUM-ALUMINUM DIVISION

Executive Offices: 230 Park Avenue, New York 17, N.Y.

Availability

Magnesium facilities were developed to help win the war. Now the supply is adequate and many applications other than in aircraft are being approved.

If your products can be improved by the use of Revere Magnesium alloys, we suggest you consult us about availability for civilian products.



Are you prepared to meet your postwar traffic problems? Increased travel. Higher speeds. More overland motor freight. All will place a burden on the traffic engineer who has a key-role in postwar planning. Better street lighting is important to solve night traffic problems . . . the most critical period for accidents.

And the traffic engineer can rely on Slater street lighting lamps for dependable, efficient service. For Slater engineering has kept pace with the technical advances in illumination to give you greater lumen output per square foot at less cost and longer lamp life.

Reliable street lighting means Slater lamps. Catalog upon request.

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BROOKLYN, NEW YORK

MANUFACTURERS OF STREET LIGHTING LAMPS, AND PRECISION ELECTRONIC TUBES

the Society's newly established research program, now in operation under the direction of board of research trustees. His major assignment during the coming year will be the compilation writing and publication of an I.E.S. Illumination Design Handbook.

•

A. Pfaltz Joins Society of Plastics Industry

Albert Pfaltz has been appointed director of public relations of the Society of the Plastics Industry, Inc.

For the past eight years a member of the senior staff of the National Electrical Manufacturers Association, Mr. Pfaltz was active in N.E.M.A. publicity, business development programs and post-war planning, and was editor of the *Adequate Wiring Reporter*, newspaper of the National Adequate Wiring Program.

•

▶ WILLIAM E. GUY, commercial manager for Graybar Electric Co. at Los Angeles, Calif., has been appointed district commercial manager in Chicago, succeeding J. H. GLEASON, who retired recently after 41 years of service. Mr. Guy was succeeded by SAM W. SCOTT as district sales manager in Los Angeles, and the latter was succeeded as merchandising manager in Los Angeles by D. H. CAPELLI, who was credit manager in Salt Lake City at the time of his transfer. J. J. MARTINEAU, who has been procurement adviser in Salt Lake City since 1942, was promoted to the position vacated by Mr. Capelli.

▶ MELVIN E. LANNING has been appointed merchandise manager of the range department of the Westinghouse Electric & Manufacturing Co. Mr. Lanning, who has been with Westinghouse for 24 years, has been stationed in the company's St. Louis office since 1937, serving successively as southwestern district range supervisor, southwestern district sales development manager and merchandise supervisor.

▶ CHRISTIAN STEENSTRUP, engineer in charge of General Electric Co.'s refrigeration engineering division, who developed the hermetically sealed refrigerator unit and is called the "father" of the company's famous suggestion system, after 43 years of service, has requested to be relieved of his responsibility as head of the division. Mr. Steenstrup will continue for the present as consultant. D. F. NEWMAN was appointed engineer of the division and L. W. ATCHISON assistant engineer. Mr. Newman was formerly assistant engi-

—Facts You Should Know about Greases

Are you familiar with the composition of lubricating greases? . . . . . Do you know the different grease types . . . their virtues . . . their weaknesses? . . . . . Are you informed about proper selection and correct application?

This and other information, vital to every industry, is contained in "Lubricating Greases," a new Sinclair brochure published by America's outstanding manufacturer of lubricants.

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If you are interested in more efficient, more economical lubrication with a greatly reduced inventory of greases you will want a copy of "Lubricating Greases." Write today for a copy—with our compliments.

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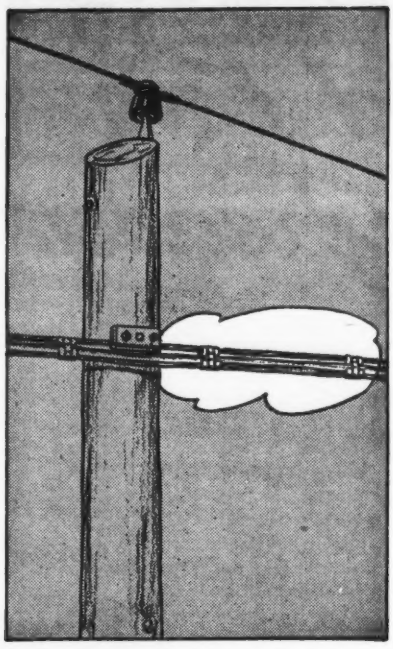
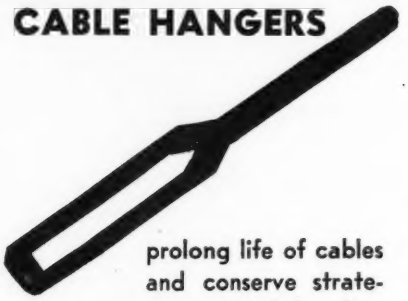
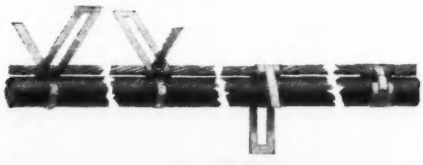
Avoid Cable Wear
Reduce Maintenance



RELIABLE CABLE HANGERS



prolong life of cables and conserve strategic materials by eliminating wear on cable sheaths or on insulation of hand made cables. Reliable cable hangers hold cable and messenger together tightly with wide bearing surfaces which eliminate snaking and chafing. They are easily applied and make installations that are permanent and very neat.



Reliable
ELECTRIC COMPANY
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neer and Mr. Atchison, designing engineer. Advocate of the modern mass production of electric refrigerators, Mr. Steenstrup has 113 patents covering many phases of refrigerator manufacture and engineering. As a result of his suggestion, G. E. Emmons, the then works manager, initiated the G-E Suggestion System. Mr. Steenstrup later became chairman of the Suggestion Committee. Now in use in all the company plants, the system has since its inauguration in 1906 paid $1,500,000 to G-E people for their ideas. Mr. Steenstrup was given a Modern Pioneer Award in 1940 by the National Association of Manufacturers. Associated with Mr. Steenstrup for a quarter of a century, Mr. Newman has 27 patents. Mr. Atchison has worked with Mr. Steenstrup on his developmental work and holds 31 patents in the refrigeration field.

▶ JOHN W. DELIND, JR. has been appointed director of exports of The Crosley Corp. For the past 25 years, Mr. DeLind has been associated with various phases of merchandising, mostly in export fields. He has for a short time established headquarters in Mexico City in order to make a survey of distributors in the surrounding territory. The main purpose of the survey is to discuss postwar plans.

▶ HAROLD M. SWITZER has been appointed treasurer and comptroller of the Eureka Vacuum Cleaner Co., Detroit. Mr. Switzer was formerly comptroller and personnel director of the Earl A. Thompson Manufacturing Co.

▶ LOUIS J. CAHILL, assistant illuminating engineer of the Benjamin Electric Mfg. Co., has been named commercial engineer of the Champion Lamp Works, Lynn, Mass. A graduate of the University of Akron, he has served with Westinghouse Electric & Manufacturing Co. and the Ohio Edison Co.

▶ F. HARVEY SEARIGHT, who has served Allis-Chalmers Manufacturing Co. for 33 years and been acting manager of the San Francisco, Calif., district during the past year, has been appointed San Francisco manager. Since 1911, Mr. Searight has been a member of the San Francisco sales and engineering office of Allis-Chalmers and has recently worked as a consultant between the manufacturing company and the Pacific Gas & Electric Co. In addition to holding membership in the Pacific Coast Electric Association for 20 years, Mr. Searight is a member of the American Institute of Electrical Engineers, and the Engineers Club of San Francisco.

▶ FRANK D. POPOWICS, associated for many years with the electrical division of Colt's Patent Firearms Manufacturing Co. in Chicago, is now a member of the sales engineering staff of Allen-Bradley Co., in New York. CHARLES M. MCCOOMBS, formerly New England district manager for Bull Dog Electric Products Co., has joined the sales engineering staff of the Allen-Bradley organization in Boston as assistant to M. H. Hallenbeck, district manager.

OBITUARY

▶ MALCOLM M. ECKHARDT, who retired as president of the Derby (Conn.) Gas & Electric Co. in 1942, died September 13. He was 66 years old and a native of Hartford. After graduation from Sheffield Scientific School of Yale University in 1900 he entered the electrical field and became superintendent of the electrical department of the Derby company in 1925. Mr. Eckhardt became secretary-treasurer and assistant general manager in 1934. He was elected president the same year and also served as general manager of the utility until his retirement two years ago.

▶ STEPHEN R. CLEMENT, associated with the Ontario Hydro-Electric Power Commission for 35 years, died suddenly at his home in Toronto, on September 14, as a result of a heart attack. He was 63 years of age. Mr. Clement was graduated from the University of Toronto in 1905 and took his first position with the General Electric Co. in Schenectady. In 1909 he returnd to Toronto to join the staff of Hydro in the municipal department and at the time of his death was assistant engineer of that department. Mr. Clement was a member of the Association of Professional Engineers of Ontario, and was secretary of the Association of Municipal Electric Utilities from the time of its inception.

▶ JASPER BLACKBURN, president of the Jasper Blackburn Products Corp., St. Louis, Mo., and vice-president of the Everstick Anchor Co., Fairfield, Iowa, died suddenly at his home in Webster Groves, Mo., on August 31, his seventy-fifth birthday. Mr. Blackburn was born at Hunnewell, Mo., and for forty years was engaged in the manufacture of telephone and electric utility items. In 1906 he organized the Everstick Anchor Co. and remained president until 1932, voluntarily relinquishing that office upon the formation of Jasper Blackburn Products Corp. He remained president of that organization until his death.

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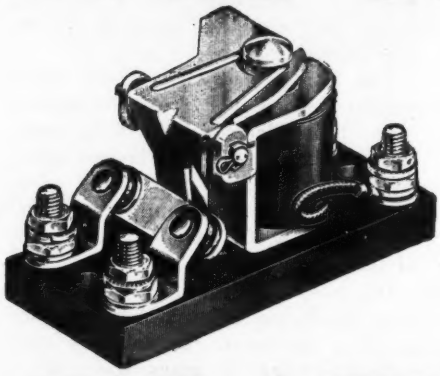
TYPES OF



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MANUFACTURING MARKETS

Large-Size Freezer Demand Predicted

When post-war home freezers are manufactured we can count on a very large demand for the relatively large size freezer, predicts Dr. D. K. Tressler, manager, General Electric Consumers Institute, Bridgeport, Connecticut.

The reasons for this were pointed out by Dr. Tressler in a talk "Home Freezers—Present and Future" before the Southeastern Freezer Locker and Home Freezer Conference at the University of Tennessee, Knoxville, Tenn., September 7.

Although the first immediate demand for home freezers may be for the 4 and 6 cu. ft. size because of their relatively lower cost, it is very probable that the public will soon turn to the larger sizes, according to Dr. Tressler's opinion.

In speaking about home freezing, Dr. Tressler, who has spent 15 years of exhaustive research on the subject, said there is not the necessity for quick freezing in home freezers, especially for foods packed in small containers. What is important is to chill the food rapidly down to below 50° F., the point where micro-organisms grow very slowly.

Dr. Tressler pointed out the need for an educational program directed to consumers to acquaint them with the correct procedure of preparing foods for freezing. "We now have a wonderful opportunity," he stated, "to see to it that everyone owning a home freezer and every locker plant operator learns how to prepare and freeze foods of superior quality."

•

War Output Rises 50%

Philco Corp.'s production of war materiel for the Army and Navy, including principally radar and radio equipment, increased 50 percent in the first six months of 1944 as compared with the corresponding period last year, according to John Ballantyne, president. "Present indications are that the rate of output achieved in the second quarter of this year, which represented a 10 percent increase over the first three months, will be maintained until Germany is defeated," Mr. Ballantyne said.

•

Fleeing Germans Strip Philips Lamps Plants

As one of their final looting acts the Germans in the Netherlands shipped to the Reich 36 carloads of machinery and technical equipment which they stripped from the Philips Lamps and Radio Works of Eindhoven, only a few days before that city was liberated by the allied troops.

The Philips factories—whose headquarters since the Nazi occupation have been located at Willemstad, Curacao, N.W.I.—are the largest industry in Holland with plants and scientific laboratories occupying 78 acres and employing 20,000 people at the time of the invasion.

On two occasions the plants were severely damaged by R.A.F. bombing attacks; moreover, the laborers committed sabotage in many ways.

Clevelanders Buy Black & Decker Unit

A group of Clevelanders, including Richard J. Lamb, president, and the other officers of the Black & Decker Electric Co., Kent, Ohio, have acquired control of the former subsidiary of Black & Decker Manufacturing Co. of Maryland.

The Black & Decker Electric Co. was organized in 1915 and operated in Cleveland independently as the Domestic Electric Co. until 1928 when all of its stock was purchased by the Black & Decker Manufacturing Co. of Baltimore and the name changed to Black & Decker Electric Co. In 1930 the company moved to Kent.

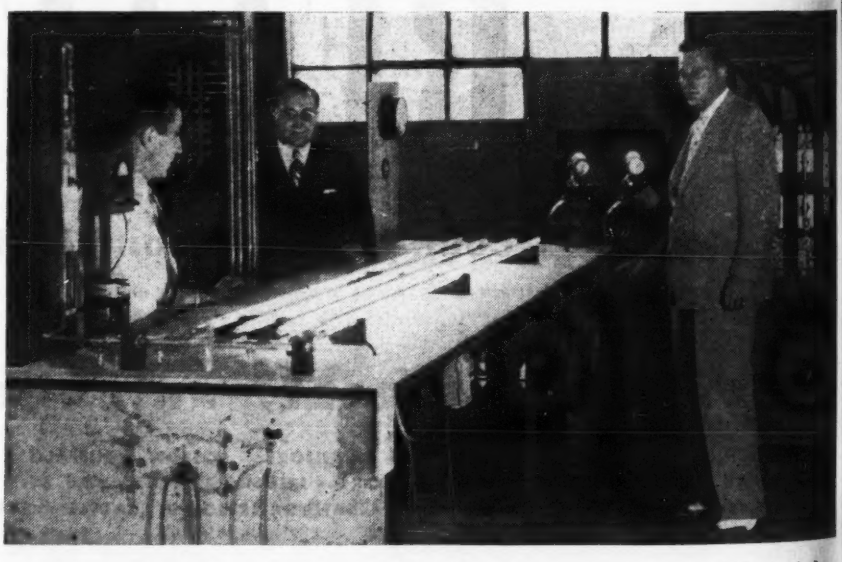
According to the announcement the name will be changed shortly to Skilcraft Electric Co. All present officers will continue in the same capacities. These include Mr. Lamb, president; Warren F. Fryburg, vice-president and general manager; Milton H. Spielman, vice-president in charge of engineering; Walter H. Poesse, vice-president and plant manager, and Arthur E. Nash, secretary and treasurer.

•

New Insulating Process Announced by Sterling

A new process for the application and treatment of insulating varnish to armatures and stators has been announced by the Sterling Varnish Co., Haysville, Pa., and Manchester, England.

Named the Zanderoll Process, after



NEW COLD CATHODE LAMP MAKER—Walter H. Simson, right, president of the Duro Test Corp., North Bergen, N. J., presses the switch lighting the first cold-cathode unit made by the company. Vice-Presidents James B. Sommers and James L. Cox, who is in charge of the new plant which will make the lamps in all standard sizes and colors, are the observers

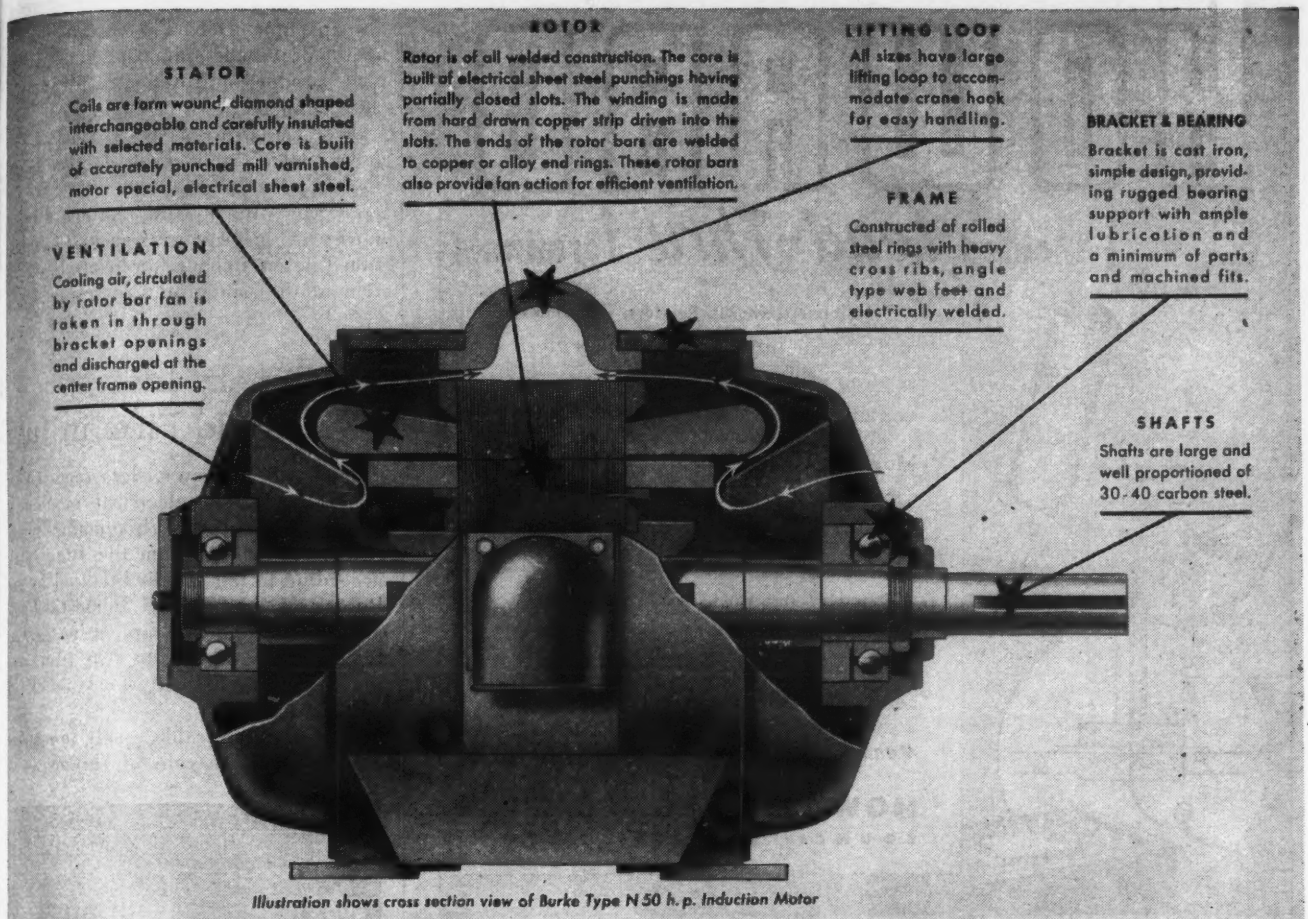
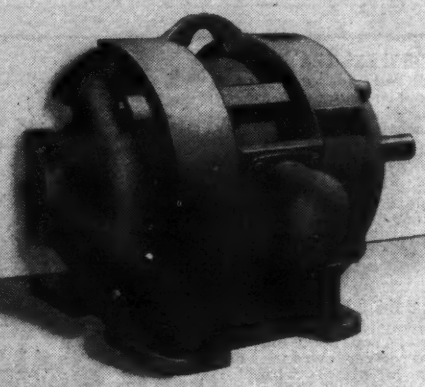

STATOR
Coils are form wound, diamond shaped interchangeable and carefully insulated with selected materials. Core is built of accurately punched mill varnished, motor special, electrical sheet steel.
ROTOR
Rotor is of all welded construction. The core is built of electrical sheet steel punchings having partially closed slots. The winding is made from hard drawn copper strip driven into the slots. The ends of the rotor bars are welded to copper or alloy end rings. These rotor bars also provide fan action for efficient ventilation.
LIFTING LOOP
All sizes have large lifting loop to accommodate crane hook for easy handling.
BRACKET & BEARING
Bracket is cast iron, simple design, providing rugged bearing support with ample lubrication and a minimum of parts and machined fits.
VENTILATION
Cooling air, circulated by rotor bar fan is taken in through bracket openings and discharged at the center frame opening.
FRAME
Constructed of rolled steel rings with heavy cross ribs, angle type web feet and electrically welded.
SHAFTS
Shafts are large and well proportioned of 30-40 carbon steel.

Illustration shows cross section view of Burke Type N 50 h. p. Induction Motor

BURKE *Induction* MOTORS

1 to 1500 h. p.



BURKE is a quality motor builder producing a standard line of motors but also able to meet exacting specifications of special applications. Burke Induction Motors are built in sizes from 1 to 1500 h. p. in all types, open and enclosed, both squirrel cage and wound rotor. Let Burke build for you. Send your specifications to Burke engineers today. Write for Bulletin 101 describing Burke Induction Motors.

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MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W.

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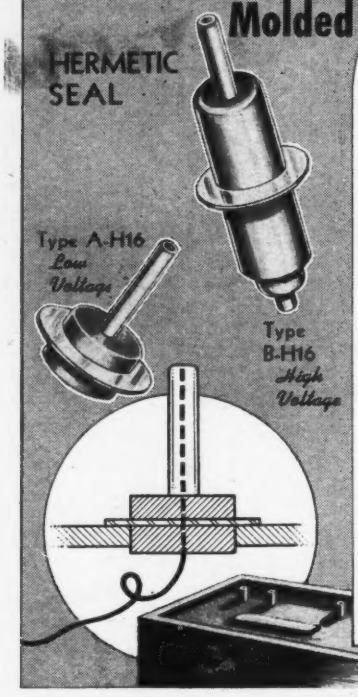

for **Transformers, Chokes, Reactors, Capacitators,** and similar units . . . where *hermetic sealing* is a "MUST" . . . or where convenience and utility are paramount.

Molded of a high dielectric, moisture-repellant, low loss material, Howard Terminals are easy to use, inexpensive, convenient and provide a positive method of hermetic sealing. Will not crack or break when soldered in place. The mounting ring and pin are cadmium plated.

Manufacturers' Inquiries Are Invited

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SOLDERLESS TERMINALS
Quick reliable connections without solder or tools. Positive, safe . . . as easy to remove as to assemble.

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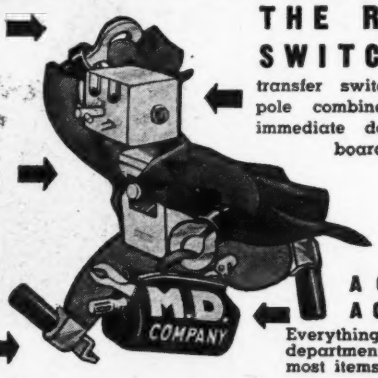
Overall indoor, outdoor or double duty. To your specifications if standard models do not answer. Equipped with or without our Slide-A-Link Test Blocks.

SOLDERLESS LUGS
Simplicity is the greatest feature. You need only a screw driver, wrench or pliers to attach wire to connector.



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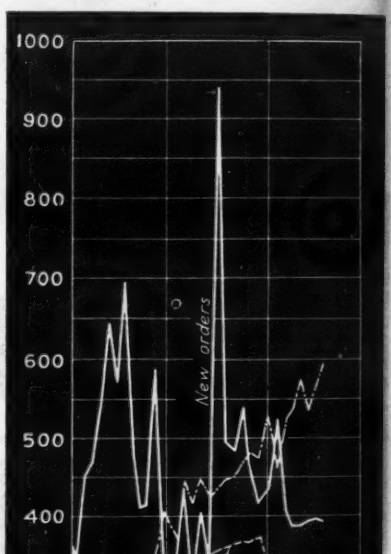
its inventor Don F. Alexander, the method provides amazing cost-saving and product-improvement advantages, according to Sterling engineers.

Fostoria Pressed Steel Corp., Fostoria, Ohio, and Fostoria Industrial Service Centers in major cities are cooperating with Sterling engineers in offering engineering service and production line equipment for licensed operation of the Zanderoll Process.

Machinery Indices Hold Firm in July

The value of new orders received by manufacturers of electrical machinery during the month of July remained practically unchanged from the June total, according to the figures released by the Bureau of Foreign and Domestic Commerce. The index compiled by the Bureau dipped slightly to 396 from 398 (revised) in June. It stood at 496 in July, 1943.

Among the durable goods industries variations in the rate of shipments in

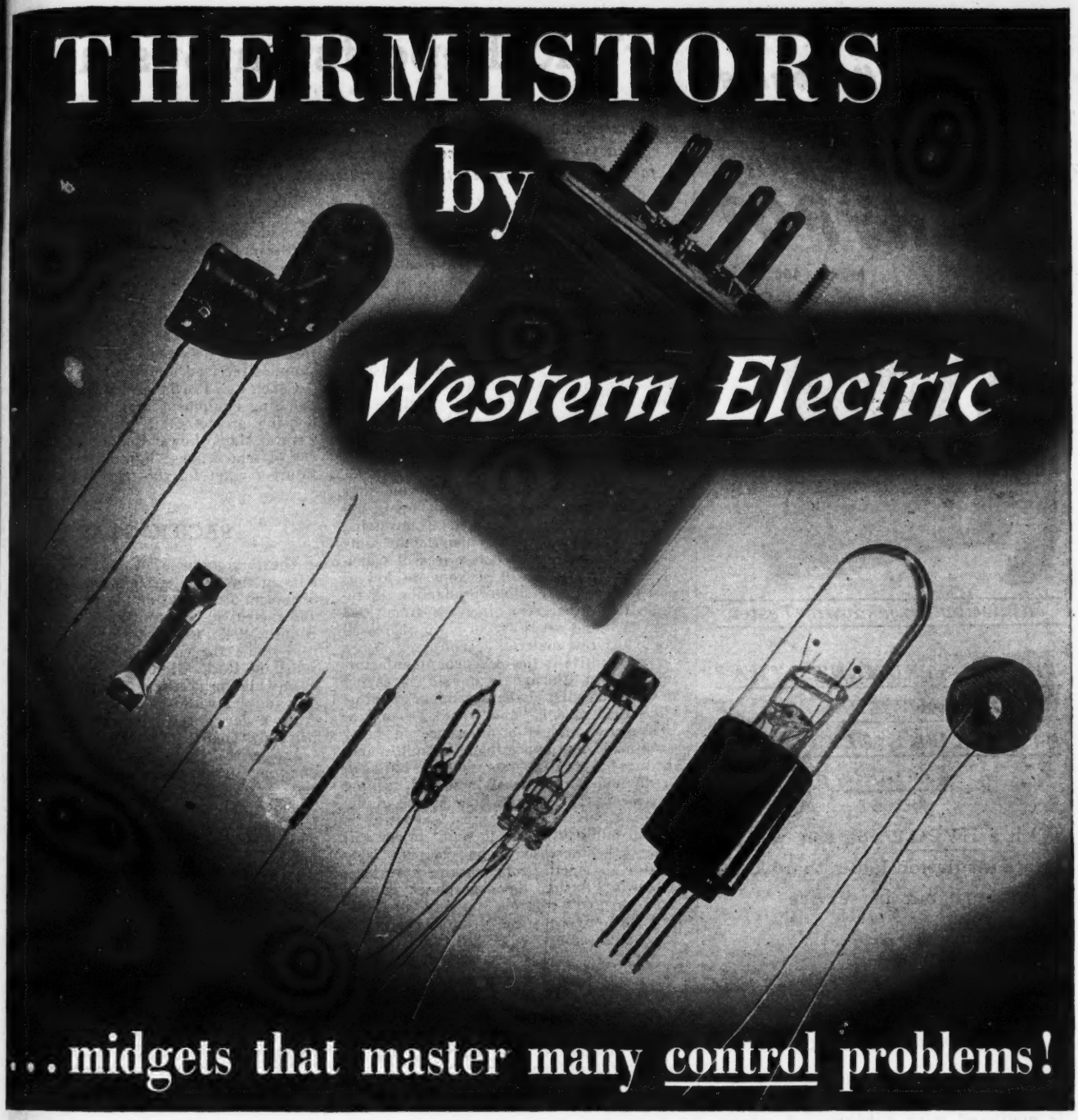


ELECTRICAL MACHINERY INDICES of Bureau of Foreign and Domestic Commerce

July from June were not sharp in either direction; slight increases were recorded for the electrical machinery group—596, June, 570; July, 1943 it stood at 449.

Electrical machinery inventories index dipped to 335.8 in July from 338.9 in June; July, 1943, 362.8.

THERMISTORS by Western Electric



...midgets that master many control problems!

THE thermistor has come of age during this war. Hundreds of thousands of Western Electric thermistors—of various types—are serving the armed forces and war industries in a constantly growing variety of ways.

Developed by Bell Telephone Laboratories, the thermistor (thermal resistor)—is a small circuit element made from materials known as semi-conductors. They are characterized by large negative temperature coefficients of resistance. The electrical resistance decreases rapidly as temperature rises—increases as temperature falls, providing a unique, simple, economical means of control.

At present, thermistors can be supplied only for war uses. However, in planning your post-war products, consider the potentialities of thermistors. Call on us if the thermal and electrical characteristics of thermistors would be of value to you.

Western Electric Company, Radio Division, 120 Broadway, New York 5, N.Y.

Buy all the War Bonds you can!
Keep all the War Bonds you buy.

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Field Reports on Business

Bidding on navy supplies has slowed down with small lots offered in a wide diversification of electrical equipment. Manufacturers are receiving DPC contracts for the purchase of additional equipment and the expansion of plant facilities for war production. Retail trade is running well ahead of last year.

CHICAGO

First appearance of electric irons on department store shelves in Chicago in almost two years is heralded for early October, but only in small quantities. Quantities to be received by individual retailers vary from 50 to 500. Prices quoted range from $5.95 to $17.50. Most of the establishments plan to put the irons on the counter and sell them first-come, first-served, although there are one or two of the stores which have accepted orders for irons in recent weeks. They will fill these orders before making public offerings.

Store representatives here indicate they expect a fairly steady but light flow of appliances after initial shipments. Canvassing of opinion among Chicago manufacturers by local agencies reveals that prices of manufacturers products will be kept "as low as possible" when civilian production is resumed, but that some increase from 1942 levels will be necessary to cover increased labor and raw material costs.

An executive in the electrical manufacturing field in Chicago is quoted as saying recently that first civilian products would be "like 1942 models" and would be sold at 1942 prices unless a difference in labor costs made this impossible. A radio manufacturing executive reports that although production costs have increased, selling prices must not go too high or the public will not buy. Still a third executive is quoted publicly as saying retail prices will have to be increased if his company is to make ends meet. Profit margins have been narrowing during the war under government-imposed controls until "something will have to be done," this executive is quoted as saying.

NEW ENGLAND

New England manufacturers are receiving DPC contracts for the purchase of additional equipment and the expansion of plant facilities for war production.

Manning-Bowman Co., Meriden, Conn., expects to begin allocation to jobbers of the electric iron quota now being produced, some time in October. Capital Products Co. Inc., Winsted, Conn., has been authorized to reconvert its facilities to the production of two-burner electric hot-plates for civilian use. Federal Electric Co., which has acquired the electrical buisness of Colt's, Hartford, will continue to manufacture in that city dish-washing machines, metal parts cleaning equipment, and moulded plastic products. Twenty two hundred watt-hour meters have been purchased for replacement use as a result of the hurricane in the New Bedford and Cape Cod area.

Among ASO contracts awarded in this area were orders to Polaroid Corp., Cambridge, Mass., amounting to $119,400, capacitors from Sprague Electric and Aerovox companies, circuit breakers from Spencer Thermostat Co., Attleborough, Mass., and switches from Mu-Switch Corp., Canton, Mass. Radio supplies are moving at a fast pace; communication apparatus manufacturers are operating at a high level. Bidding on navy supplies has slowed down with small lots offered in a wide diversification of electrical equipment. Bids for several lots of 250-kva transformers were placed for Panama, and wiring supplies in fair-sized quantities were headliners. Lots running as high as 10,000 galvanized squeeze type connectors, electric vision testing units, heater switches, plug fuses, call bell systems and communication supplies received attention.

Coken Co., Providence, R. I., is installing metering equipment at a Hartford, Conn., housing project under direction of NHA. Central Maine Power Co. is planning a survey of school house lighting to outline the future market for this class of service.

PACIFIC COAST

The total value of August building permits in the seven western states decreased 5 percent from that of the previous month and increased 2 percent above the total for August, 1943. California decreased 20 percent under the corresponding total of last year; the Rocky Mountain States ran about even while the Northwest contrary to recent showing increased more than 40 percent. After a dormant August considerable new privately financed housing is recorded.

Prospective business includes the Bixler pumping system near Brentwood, Calif., costing $750,000; about $120,000 of long distance switching and repeater equipment for Oceanside; six 250 hp. motors and magnetic starters for City of Oakland and pumps for a series of underpasses necessitated by war industrial traffic. Pumping motors of all sizes and distribution transformers are the nucleus of present power apparatus business which is feeling the temporary decline of marine propulsion equipment .

Industrial developments include a million-dollar subsidiary of Standard Oil where Oronite Chemical Co. will produce the basic stock for paints and varnishes; a $400,000 rubber guayule mill and $350,000 appropriated for research at a basic magnesium plant in Nevada.

NEW YORK

Civil engineering construction volume in continental U. S. totaled $19,235,000 last week, the second lowest volume reported to Engineering News-Record in 1944. The week's total was 55 percent below the preceding week and was 73 percent under the corresponding 1943 week. Private construction was 37 and 54 percent lower, respectively, than the preceding week and a year ago. Public work was down 58 percent compared with the preceding week, and was 76 percent below last year as both state and municipal volume and federal construction reported decreases. The week's construction brought 1944 volume to $1,348,716,000 for the 38-week period, a decrease of 45 percent from the $2,437,651,000 reported in 1943.

According to the preliminary report issued by the Federal Reserve Bank of New York, sales of department stores in the Metropolitan area showed an increase of 15 percent over the similar week last year.

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(A) This emblem signifies that a single test has been completed. It denotes that such a test has been made at ETL, and a report has been issued. This test may or may not have been made upon random sampling. The report itself describes the sampling procedure.

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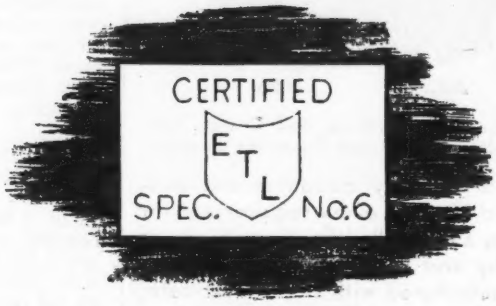
(a)



(b)

It takes a deal of time, labor, experience and equipment for any individual company to conduct even a simple test . . . . one that will bring to light pertinent facts about the material or product.

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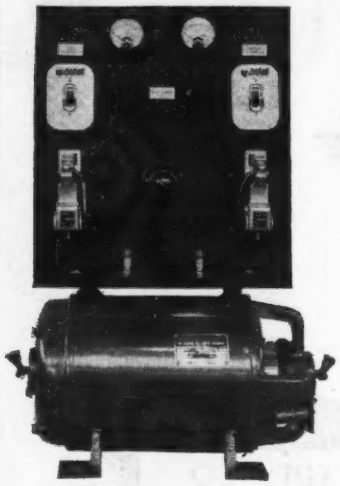

(Illustrated is a IK.W.-60 Cell Charger with unit mounted Motor and Generator Controls)

- - - is specially designed and constructed to meet every requirement for insuring a controlled floating charge of Standby and Control Batteries.

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Some of the inherent characteristics that have insured this performance in thousands of installations are:—

Un-attended, completely automatic, constant charging voltage controlled within very close limits under all loads . . . a continuous floating charge to the battery day and night . . . it protects itself against dangerous overloads by shifting all excess load onto the battery . . . is free from any characteristics of "running away" or reversal of polarity . . . is both mechanically and electrically quiet . . . and is economical in operation and maintenance.

The Diverter Pole Motor Generator is an investment that will pay you dividends from the start.

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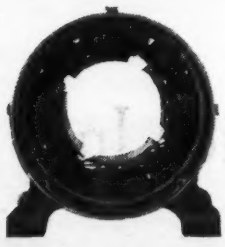

Diverter Pole Construction

The Electric Products Co.
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Sales Opportunities

LOUISIANA—Louisiana Power & Light Co., New Orleans, plans extensions in transmission lines in Atchafalaya River district, including an aerial crossing over Bayou Lafourche. Application has been made for permission and work is scheduled to begin soon.

IOWA—Municipal Utilities Department, Indianola, has authorized plans for expansion in municipal electric power plant, with installation of equipment for increased capacity. Project will be carried out as a post-war development and is estimated to cost about $100,000. Buell & Winter Engineering Co., Insurance Exchange Bldg., Sioux City, is consulting engineer.

TEXAS—Water and Sewer Department, Liberty, plans installation of motor-driven machinery, with controls and auxiliary equipment, in connection with post-war expansion and improvement program for water and sewage systems; cost estimated about $100,000. Garrett Engineering Co., 1806 Milam St., Houston, is consulting engineer.

NEW MEXICO—Bureau of Reclamation, Denver, Colo., will receive bids until October 12 for two radial gates, 16 by 9 ft., and 12 by 9 ft., respectively, with rollers, pin bearings and accessory equipment; also for two 5,000-lb. capacity, manually operated, radial gate hoists, complete with auxiliaries, all for installation in check and wasteway in Conchas Canal, Station 1812-57, Tucumcari project. Equipment will be installed by government (Specifications 1770-D).

IOWA—Iowa Public Service Co., Sioux City, has awarded contract to Geiger Construction Co., Sheldon, for building modernization and remodeling for electric generating station. Installation will include new diesel-electric generating unit with accessories, cooling tower and auxiliary equipment. Cost estimated about $100,000.

NEW YORK—International Business Machines Corp., 590 Madison Ave., New York, will make extensions in branch plant, now in production for precision apparatus for government, including additional buildings, with installation of machinery and electrical equipment for increased capacity. Cost estimated about $1,750,000, with financing by Defense Plant Corp. Work will be carried out at once.

WISCONSIN—Barron County Electric Cooperative, Barron, Willis Jerome, secretary, has plans for new power substation and will place work under way at early date. It is understood that project has a priority. Office of Wisconsin Electric Cooperative, Inc., 303 East Wilson St., Madison, is engineer.

OREGON—Bureau of Yards and Docks, Navy Department, Washington, D. C., plans expansion in naval air stations, including hangars, shops, warehouses and other structures, with mechanical and electrical equipment. Also extensions in electrical distribution systems, with service connections and other facilities. Cost estimated about $1,000,000 and $500,000, in order noted. Bids are scheduled to be asked soon. Glenn Stanton and Hollis Johnson, Railway Exchange Bldg., Portland, are architects. Projects will be carried out under direction of Officer in Charge of Construction, Naval Air Center, Sandpoint, Seattle, Wash.

MISSOURI—American Car & Foundry Co., St. Charles, plans expansion in local passenger car construction plant, including two new one-story buildings, totaling 90,000 sq. ft. floor space, with machinery and electrical equipment to double present production facilities. Cost estimated about $1,500,000. It is understood that project will have a priority rating. Main offices are at 30 Church St., New York, N. Y.

PENNSYLVANIA — Philadelphia Electric Co., Philadelphia, has contracted with Bureau of Yards and Docks, Navy Department, Washington, D. C., for construction of new feeder line to Philadelphia Navy Yard, for electric service in section of yard. Cost about $124,655.

KANSAS—Board of Public Utilities, Kansas City, has completed plans for new underground transmission line from generating station to substation. Cost about $1[illegible],000. Work is scheduled to begin at early date. Burns & McDonnell Engineering Co., 107 West Linwood Blvd., Kansas City, Mo., is consulting engineer.

ILLINOIS—R. G. Le Tourneau, Inc., Peoria, manufacturer of road machinery, now in production for government, will make extensions in plant, including additional buildings, with machinery and electrical equipment. Cost estimated about $1,300,000, with financing by Defense Plant Corp. Work will be carried out at once.

MICHIGAN—Public Lighting Commission, 174 East Atwater St., Detroit, plans new power substation, to be known as Northeast substation, in connection with post-war expansion and improvement program for municipal lighting system. Cost estimated about $300,000, with transformers, switchgear and auxiliary equipment. Also will make extensions in main thoroughfare street-lighting system in different parts of city, to cost approximately $900,000, with fixtures, underground and overhead lines, and other operating facilities. A similar project will be carried out in residental area, to cost about $400,000. This work supplements new post-war generating station to cost over $4,000,000. Another project now planned for post-war development is construction of transmission line to pumping station, for power supply for operation, to cost about $150,000. Water Department, 735 Randolph St., plans complete electrification of pumping plant, with installation of motors, controls, new pumping units and auxiliary equipment. This likewise will be a post-war project.

NEW YORK—Consolidated Edison Co., 4 Irving Pl., New York, has plans for new one-story building and yard facilities, for storage and distribution of equipment and materials. Work is scheduled to begin soon. A priority rating has been secured.

INDIANA—Municipal Electric Lighting and Power Department, Richmond, is considering improvements in power plant, including new cooling tower and other facilities. Appropriation is being arranged. It is understood that application will be made for a priority rating.

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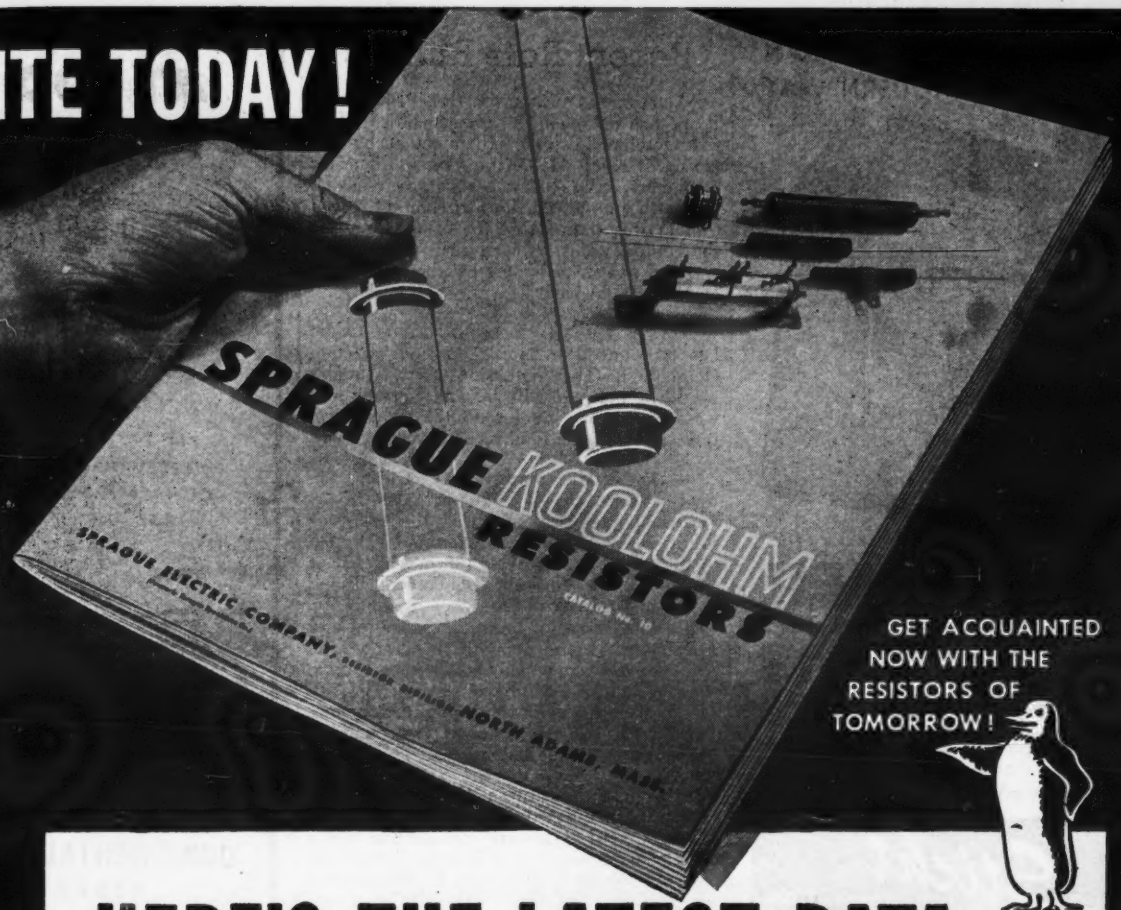

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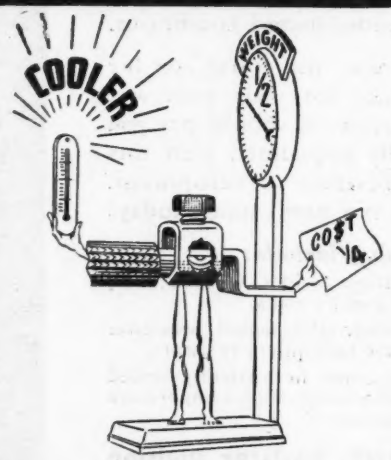

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ILSCO CONNECTORS are cooler, lighter, and cheaper because they're built from 100% electrolytic pure copper drawn right in our own plant. Cast connectors, of course, are made of alloy copper with poor conductivity.

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Recent Rate Rulings

NARRAGANSETT ELECTRIC CO., Providence, R. I., has established rate schedules effective October 1 which will effect an annual saving of about $450,000 a year to domestic customers, or about 6 percent. Gov. J. H. McGrath announced the forthcoming reduction, stating that during the past six months the company has reduced rates to commercial and power customers by about $200,000 on the annual basis.

LOWELL (MASS.) ELECTRIC LIGHT CORP. has announced a rate reduction effective October 1. The reduction to consumers would be between $40,000 and $50,000, and would bring the total reduction in electric rates made since 1935 to $320,000.

ARKANSAS-MISSOURI POWER CORP. has filed a schedule of reduced rates to 10 northeast Arkansas cities with the Arkansas Utilities Commission. The reduction in cost to the cities will total $4,188 a year. Cities which will benefit are: Black Oak, Black Rock, Blytheville, Caraway, Lake City, Leachville, Luxora, Manila, Monette and Pocahontas. In addition to the cost reduction, the power company has agreed to give the cities all night lighting service. The city of Hoxie, which was not included among those receiving the reduced rate, will be granted the all-night service.

SAFE HARBOR POWER CO. rate charges to the Consolidated Gas Electric Light & Power Co. of Baltimore for electric power will be determined at a hearing before the Federal Power Commission in Washington on October 30. Action by the FPC to determine the rates charged the Gas and Electric Company by both the Safe Harbor company and the Pennsylvania Water & Power Co. was asked sometime ago as part of the efforts of Philip H. Dorsey, People's Counsel for the Maryland Public Service Commission to obtain a reduction in rates for the public. No date has been fixed thus far by the FPC for a hearing on the rates of the Pennsylvania Water & Power Co. Hearing in the rate reduction case before the Maryland Public Service Commission, which was started sometime ago and adjourned, will be resumed on October 15.

•

G.E. Will Produce More Fractional Hp. Motors

General Electric Co. will spend $550,000 on new facilities for the production of a.c. fractional horsepower motors at Norwood, Mass., in an attempt to reduce the existing heavy backlog of orders for this type of motor.

The operation will be carried on in a loose labor area, utilizing labor freed by the cutback of a Navy order.

•

Gets $40,000,000 Credit

Announcement has been made by the Emerson Electric Manufacturing Co. that it had obtained a $40,000,000 revolving credit from the First National Bank of St. Louis, the Mississippi Valley Trust Co. and other banks and trust companies.

AT 100 MC
DILECTENE
A C-D Engineered U-H-F Insulation

POWER FACTOR 0.0033
DIELECTRIC CONSTANT 3.57
READILY MACHINED

◆ STABLE UNDER ◆ High Humidity ◆ Temperature Extremes ◆ Mechanical Stress ◆ Chemical Conditions

For complete technical data, send for Bulletin DN

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Ask the distributor of *Crapo* Galvanized Products near you or write direct for further information!

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PLAN YOUR PLANT DRIVE NOW!

Good organization will be needed to sell the 6th. The task of raising the huge sum required will be the most difficult ever asked of Industry. As each new military success brings us closer to Victory, the public naturally will feel that the urgency of war financing is lessened—whereas it isn't. So organize now to prevent a letdown on the home-front from causing a letdown on the fighting front. Build your plant's payroll campaign around this fighting 8-Point Plan. You don't have to wait for the official Drive to start—swing into action NOW!

1 **BOND COMMITTEE**—Appoint a 6th War Loan Bond Committee from labor, management and each representative group of the firm.

2 **TEAM CAPTAINS**—Select a team captain, for each 10 workers, from men and women on the payroll—but not in a supervisory capacity. Returned veterans make most effective captains.

3 **QUOTA**—Set a quota for each department and each employee.

4 **MEETING OF CAPTAINS**—Give a powerful presentation of the importance of the work assigned to them. Instruct them in sales procedure. Have them carefully study the Treasury Booklet, *Getting the Order.*

5 **ASSIGNMENTS**—Assign responsibilities for:

(a) *Music, speeches and announcements of the opening rally.*

(b) *Pre-drive letter to employees from management and labor.*

(c) *Competitive progress boards.*

(d) *Meeting schedules, etc.*

6 **CARD FOR EACH WORKER**—Dignify each personal approach with a pledge, order, or authorization card made out in the name of each worker. Provide for a cash purchase or installment pledge. Instruct each captain to put a pencil notation on the card to indicate the subscription he expects to solicit from each worker.

7 **RESOLICITATION**—People don't mind being asked to buy more than once. Resolicit each employee toward the end of the drive in a fast mop-up campaign. Call upon your State Payroll Chairman; he's ready with a fully detailed plan—NOW!

8 **ADVERTISE THE DRIVE**—Use all possible space in the regular media you employ to tell the War Bond story.

The Treasury Department acknowledges with appreciation the publication of this message by

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New Funds Allotted for Rural Projects

Loan allotments totaling $1,423,000, to 18 rural cooperatives in ten states, were recently approved by the Rural Electrification Administration. These funds, which will be used chiefly for the extension of electric service to farms which can make a substantial contribution to the food production program, bring total REA allotments to $506,333,301, of which $7,453,000 represents operations during the current fiscal year.

Unless otherwise noted the loans listed below will provide for farmstead connections.

ILLINOIS—Illinois Valley Electric Cooperative, Inc., Princeton, $125,000.

IOWA—Allamakee-Clayton Electric Cooperative, Inc., Postville, $125,000; Butler County Rural Electric Cooperative, Allison, $80,000; Farmers' Electric Cooperative, Inc., Greenfield, $75,000; Southern Iowa Electric Cooperative, Inc., Bloomfield, $75,000; Pocahontas County Rural Electric Cooperative, Pocahontas, $50,000; Lyon Rural Electric Cooperative, Rock Rapids, $25,000.

LOUISIANA—Claiborne Electric Cooperative, Inc., Homer, $310,000.

MINNESOTA—Todd-Wadena Power & Light Cooperative Assn., Wadena, $150,000; Southwestern Minnesota Cooperative Electric, Pipestone, $60,000; Roseau Electric Cooperative, Inc., Roseau, $60,000.

NEW YORK—Delaware County Electric Cooperative, Inc., Delhi, $8,000 for purchase and improvement of building to be used as headquarters facilities.

NORTH CAROLINA — Haywood Electric Membership Corp., Waynesville, $15,000.

NORTH DAKOTA—Tri-County Electric Cooperative, Inc., Carrington, $75,000.

OKLAHOMA—Verdigris Valley Electric Cooperative, Inc., Collinsville, $50,000.

SOUTH CAROLINA—Aiken Electric Cooperative, Inc., Aiken, $20,000 to construct additional refrigeration bulk storage and a slaughtering plant.

TEXAS—McCulloch County Electric Cooperative, Inc., Brady, $50,000; Erath County Electric Cooperative Assn., Stephenville, $70,000.

•

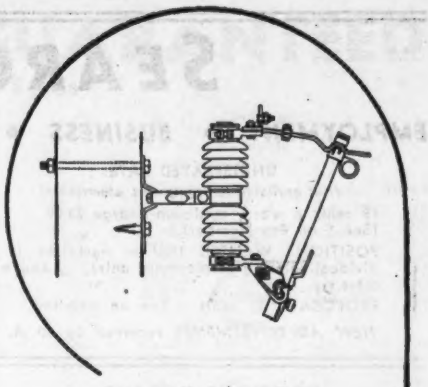
Joins NECA as Chapter

Virginia Electrical Contractors' Association, Inc., of Richmond, of which J. D. Richardson is president, has changed its name to Virginia Chapter, National Electrical Contractors Association, Inc., according to an amendment filed with the Virginia Corporation Commission.

•

Carrier Issue Offered

Offering was recently made of the unsubscribed portion of 70,000 new shares of Carrier Corp. $50 par value 4½ percent cumulative preferred stock at $50 a share. The offering to the public consisted of 12,867 shares, the balance having been taken by common stockholders and regular employees under offers that expired on Aug. 25.



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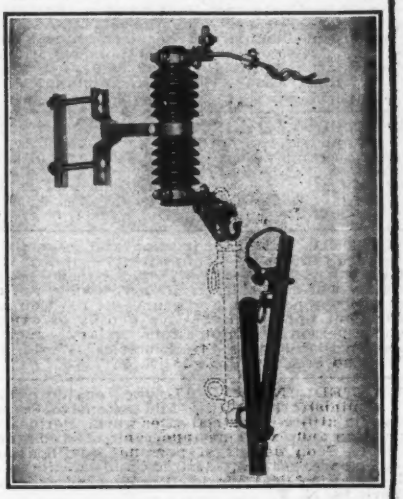

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ELECTRICAL AND HYDRAULIC engineers experienced in design and construction. Permanent positions open in Wisconsin. Essential, with excellent postwar prospects. Applications from demobilized servicemen welcome. Send details of age, education, experience, draft status, availability, and salary expected. P-736, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: COMMERCIAL sales engineer with administrative ability and long experience in utility commercial sales work. Permanent position and excellent opportunity. Send details of experience, personal qualifications and salary desired. P-747, Electrical World, 330 W. 42nd St., New York 18, N. Y

WANTED: SALES promotion and advertising consultant with administrative ability and long experience in sales promotion and advertising work. Utility and advertising agency experience preferable. Permanent position and excellent opportunity. Give details of experience, personal qualifications, salary expected and availability. P-748, Electrical World, 330 W. 42nd St., New York 18, N. Y.

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ANYTHING within reason that is wanted in the field served by Electrical World can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

ELECTRICAL ENGINEER WANTED

Electrical engineer wanted who is experienced in industrial plant design to work in mechanical engineering and drafting office of a manufacturer of electrical conductors located in New York State.

P-722, Electrical World
330 W. 42nd St., New York 18, N. Y.

MECHANICAL AND ELECTRICAL DESIGNER WANTED

For new product development. Applicant must be qualified as mechanical designer with background of experience in electrical fittings and appliances. Must also be experienced in modern tool design, production costs and methods. Give full particulars.

CURTIS LIGHTING, INC.
6135 WEST 65TH ST. CHICAGO 38, ILL.

SELLING OPPORTUNITIES
OFFERED—WANTED

SALESMAN WANTED

WANTED—SALESMAN who has experience on transformer sales and repairs, covering New England, New York State and Pennsylvania. We want a high type man who has had engineering experience on transformers and power apparatus. SW-751, Electrical World, 330 W. 42nd St., New York 18, N. Y.

REPRESENTATIVE AVAILABLE

TECHNICALLY TRAINED man, 17 years wide industrial experience would like connection as sales representative for electrical manufacturer or distributor. Willing to travel. W. C. Brooks, Cleveland 11, Ohio.

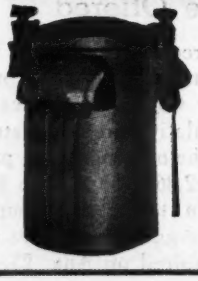
READY TO BUY
Industrial Plants

Our organization has specialized on purchase and disposal of large industrial plants for more than 30 years. Owners of properties have received successful results. We are NOT auctioneers or brokers.

Correspondence Invited

BROWN-STRAUSS CORP.
1402-1720 Guinotte, Kansas City 10, Mo.
Established 1908

—TRANSFORMERS—



BOUGHT and SOLD

We have several thousand transformers in stock for prompt shipment, and invite your inquiries.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.

One Year Guarantee

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI 27, OHIO

SEARCHLIGHT SECTION

SUCCESSFUL OPERATION GUARANTEED

Every Machine in This Ad is Owned Outright By Us

D C MOTORS

HP	Make	Type	Volts	Speed
1250	G.E.	MPC	550	130
1200	Whse.	Compen.	550	600/720
800	G.E.	MPC	660	600
625	G.E.	MPC	500	130
600	G.E.	MPC	600	650/900
500	G.E.	MPC	230	900
500	Whse.	Compen.	250	840/720
350	G.E.	MPC	220	450
300	G.E.	DMC	230	400/600
300	G.E.	MPC	230	275/550
250	G.E.	C	230	375
250	Al. Ch.		230	525
200	Whse.		230	400
175	Whse.	SK	250	150/525
150	G.E.	MPC	230	250/450
150	G.E.	RC-19A	230	800/1000
130	Cr. Wh.	CMC-65H	550	1200
130	Whse.	SK-185	110	450/1340
125	G.E.	CO-1832	230	625
100	G.E.	LC-50	230	1200
100	G.E.	MPC	230	225/450
100	G.E.	RC-38	230	600
100	Al. Ch.	Int.	230	950/1150
75/100	Whse.	SK-183	230	450/900
75	G.E.	LC	230	500/1000
75	Whse.	SK-183	230	560/1100
60	El. Dy.	25S	230	525/1050
50/60	Cr. Wh.	65H	230	500/1000
50	Cr. Wh.	CMC-81H	230	300/900
50	G.E.	RC-19	230	400/1200

TRANSFORMERS

KVA	Make	PH	Type	Voltage
1667	Pitts.	1	OISC	13200x2300
1050	G.E.	3	WCTH	11000x445
600	G.E.	3	HT-OISC	11550x2200
333	Moloney	1	C-OISC	22000/11000x2300/575
333	Whse.	1	OISC	2300x460
333	Pitts.	1	OISC	2400x220
300	G.E.	1	H-RP	13200x575/1150/2300
300	Pitts.	3	ODSC	4150x208/120
300	Packard	1	OISC	2200x220/440
200	G.E.	1	H-IDD	26400x115/460

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1500 KW GE 275 V. Gen. d.c. to 2100 HP 2300 V.
1—1000 KW Whse 600 V. Gen. d.c. to 1400 HP 4000 V.
1—1000 KW G. E. 250 V. DC to 1400 HP—2300 V.
1—500 KW G. E. 250 V. DC to 700 HP—440/2200 V.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
1—400 KW GE 250/275 V. Gen. d.c. to 650 HP—2300 V.
1—350 KW G. E. 220 v AC Gen. d.c. to 500 HP 250 v DC motor.
1—250 KW G. E. 250 V. DC to 375 HP—440 V.
1—300 KW G. E. 250 V. DC to 400 KVA—2300
1—75 KW G. E. 125 V. Gen. to 120 HP IK 400/2300
1—50 KW GE 125 V. Gen. to 75 HP KT 4000/2300 V.
1—35 KW Whse 125 V. DC to 53 HP—440/2200 V.
1—25 KW G. E. 250 V. DC to 40 HP—220 V.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

ROTARY CONVERTERS

60 cycle

KW	Make	Speed	D.C. Volt	Trans. Volts
1— 1500	Whse.	720	600	2300
1— 1500	Whse.	600	600	11500
1— 1250	G.E.	720	250	2300
1— 1000	G.E.	900	600	13200
1— 1000	Whse.	600	250	22000
1— 1000	Whse.	900	600	11000
1— 750	G.E.	1200	600	2300
1— 750	Whse.	720	250	6600/2300
1— 500	Whse.	1200	600	13200/2300
1— 375	G.E.	1200	250	6600/2300
2— 300	G.E.	1200	600	2300

25 cycle

2—	1500	G.E.	500	225/275	13200/6600
1—	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC controls.

A. C. MOTORS

3 ph. 60 cycle
Synchronous

	HP	Make	Type	Volts	Speed
2—	2100	G.E.	ATI	2300/4600	514
1—	600	Al. Ch.		2200	720
1—	400	G.E.	TS-7647	2300	720
1—	300	G.E.	ATI	440	600
1—	150	Whse.		4000	1800
1—	225	G.E.	ATI	240	600
1—	100	Whse.	G	2200	1800
1—	75	G.E.	TS-7556	220/440	600

Slip Ring

1—	1200	Cr.-Wh.	801-Q	2200	237
2—	1000	Whse.	CW	2300	720
1—	800	Al. Ch.		440	885
1—	600	G.E.	MT	550	220
2—	600	G.E.	IP	440/2200	720
1—	450	Whse.	CW	2200	875
1—	400	G.E.	IP	440/2200	600
1—	400	Al. Ch.		2300	505
1—	400	G.E.	IP	2200	252
1—	300	G.E.	IM	2300/4000	257
1—	300	G.E.	IM	440	720
1—	250	G.E.	MT	4000/2300	257
1—	200	Whse.	CW	2200	514
1—	200	G.E.	IM	440	600
1—	150	Whse.	CW-772C	2200	1160
1—	150	G.E.	IM	2200	575

Squirrel Cage

1—	300	Whse.	CS	550	580
1—	300	G.E.	IK	2300	600
1—	175/112	G.E.	IK	440	900/720
1—	125	Whse.	CS	220/550	1150
1—	100	G.E.	IE-13	2200	1800

SYNCHRONOUS CONDENSERS

1—	1000	G.E.	ATI	2200/3800	900
1—	900	G.E.	ATI	2200, 6600	1200
1—	750	G.E.	ATI	220/440	900

RENUBILT BELYEA MOTORS

What are your requirements? units up to 5000 kw available in stock.

BELYEA COMPANY INC.

Main Office & Shop: 51 HOWELL ST., JERSEY CITY, N. J.

J. L. HEMPHILL & CO. Inc.
ELECTRICAL ENGINEERS AND EQUIPMENT
1607 53rd Street North Bergen, N. J.
N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: UNion 3-2600

MOTORS

3 PHASE 60 CYCLE

1—500 HP, 900 RPM, 440 volt, Lincoln slip ring
1—350 HP, 300 RPM, 440 volt, G.E. slip ring
1—300 HP., 720 RPM, 2200 volt, G.E. slip ring
1—250 HP, 600 RPM, 4000 volt, G.E. sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl rg.
1—200 HP, 450 RPM, 2200/4000 v. G.E. sl. rg.
1—150 HP, 1800 RPM, 440 volts, G.E. sq. cg.
2—150 HP, 1200 RPM, Westinghouse, squirrel cage
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
2— 75 HP, 1200 RPM, 2300 volt, G.E. vertical

D. C. 230 VOLTS

2—450 HP, 400 RPM, General Electric MPL.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, 550 RPM, Westinghouse, SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, 625 RPM, G.E.
1— 80 HP, Crocker-Wheeler, 600 RPM.
1— 75 HP, 575 RPM, General Electric
3— 50 HP, 700 RPM, Crocker-Wheeler

VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electric Dynamic.
1—60 HP, 500/1000 RPM, Diehl.
1—30 HP, 225/900 RPM, Crocker-Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
2—25 HP, 650/2200 RPM, Westinghouse.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—15 HP, 300/1200 RPM, General Electric.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1— 5 HP, 600/1200 RPM, General Electric.
1— 5 HP, 450/1800 RPM, Crocker-Wheeler.

MOTOR GENERATOR SETS

1—750 KW, 250 volt, Allis-Chalmers, Synchronous.
1— 75 KW, 125 volt, General Electric, squirrel cage.

TRANSFORMERS

2—400 KVA, G.E. 4156-240/480 v. Scott taps.
3—300 KVA, Pittsburgh 7800/440 volts.
3—200 KVA, Allis-Chalmers, 2200/220/440 volts.
3—150 KVA, G.E., 33,000 2300/4000 Y.
4—150 KVA, G.E., 2400/240/480.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, Allis-Chalmers, 2200/220/110.
3— 75 KVA, General Electric 2200/220/440.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
1—200 KVA, 3600 RPM, 240 volt, Allis-Chalmers.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chalmers.

TURBO-GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

ENGINE GENERATOR SETS

1—150 KVA, General Electric Generator, Ames Uniflow engine.
1—62½ KVA, Westinghouse Generator, Fairbanks company engine.

Complete Line of A.C. and D.C. Motors and Generators

Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries Transformers, Motors, Compressors, Induction Voltage Regulators, Oil Circuit Breakers, etc.

Service backed by 40 years' experience

BREW, WOLTMAN & CO.
52 Church St., New York 7, N. Y.

DIESELS

ROBERT SCHOONMAKER
Port Washington.. Long Island. N.Y
Phone Roslyn 1220

60-TON LOCOMOTIVE

Storage Battery Type, built by General Electric Co. in 1930. Double truck, 4-motor type, each 75 H.P. Steeple cab. Good condition.

Complete specifications available.

IRON & STEEL PRODUCTS, INC.
13438 S. Brainard Ave., Chicago 33, Ill.
"ANYTHING containing IRON or STEEL"

For Every Business Want

Think "Searchlight" First!

"Searchlight" — classified Advertising — "spots" current Employment, Equipment and Business Opportunities—both offered and wanted—in the industry served by Electrical World.

100 KV TRANSFORMER

For sale unused 100 KV 5 KVA testing apparatus with complete control panel, voltmeter, circuit breaker, Variac. Pri 120/240 volt sec 50/100 KV Single phase 60 cycle

TITANIUM ALLOY MFG. COMPANY
Niagara Falls, N. Y.

COPPER CABLE

8,000 to 10,000 Ft. 500,000 and 750,000 C.M. Lead Covered, Insulated, 600 Volt Copper Cable. Excellent Condition. Prompt Shipment.

DELTA EQUIPMENT CO.
148 N. 3rd St. Phila. 6, Pa.

ADVERTISING IN THIS ISSUE

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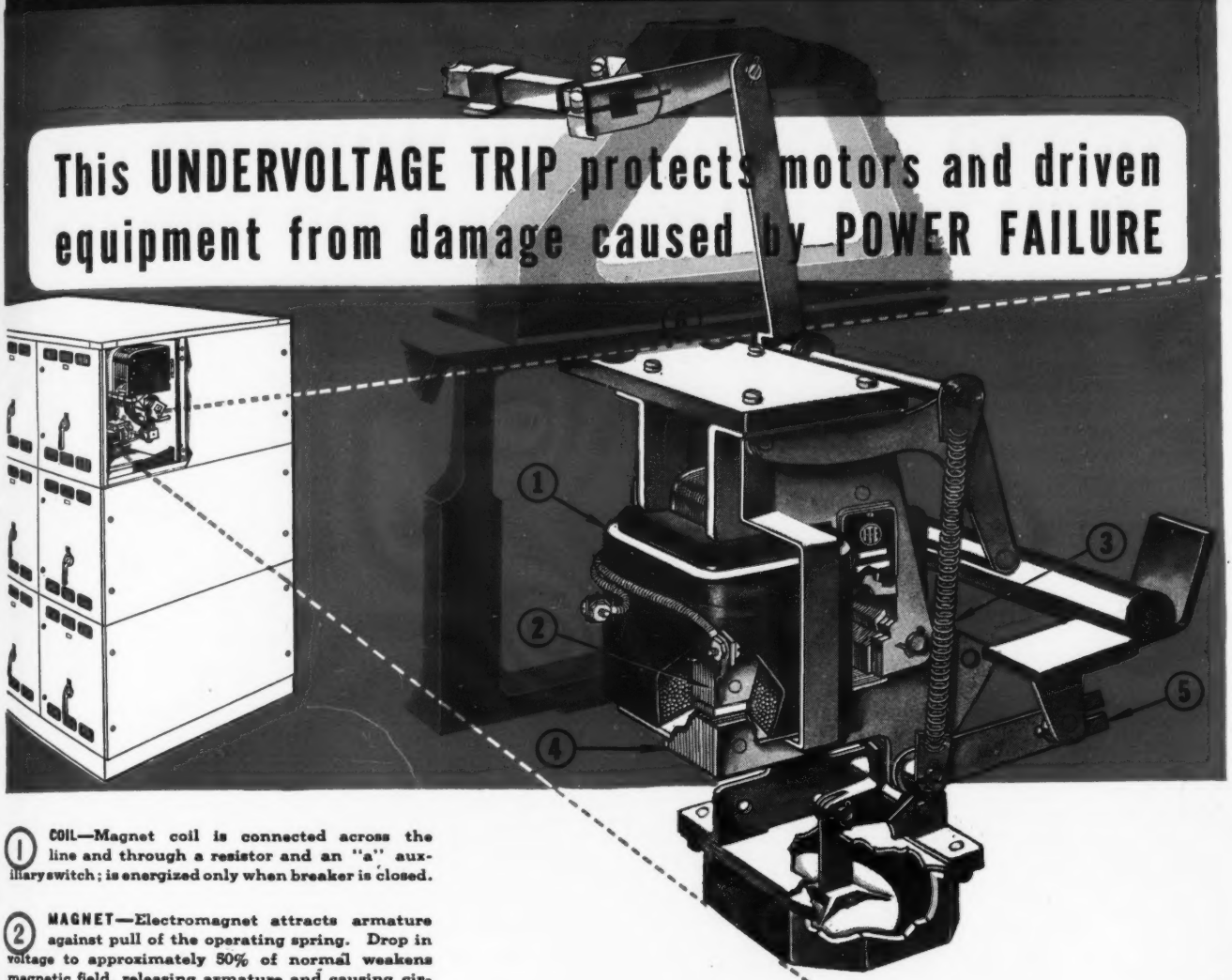
★ **These companies have supplied additional buying information on their products in the 1944 edition of the Electrical Buyers' Reference**

Features of I-T-E DRAWOUT SWITCHGEAR

This UNDERVOLTAGE TRIP protects motors and driven equipment from damage caused by POWER FAILURE



(1) **COIL**—Magnet coil is connected across the line and through a resistor and an "a" auxiliary switch; is energized only when breaker is closed.

(2) **MAGNET**—Electromagnet attracts armature against pull of the operating spring. Drop in voltage to approximately 50% of normal weakens magnetic field, releasing armature and causing circuit breaker to open.

(3) **OPERATING SPRING**—When circuit breaker is open, spring holds armature against faces of magnet poles. When circuit breaker is closed a change in position of the linkage makes spring tend to pull armature away. Magnet resists this action.

(4) **ARMATURE**—Attracted by magnet against the pull of the operating spring when circuit breaker is closed. Release of armature opens breaker through link to tripper bar.

(5) **LINK TO TRIPPER BAR**—Transmits movement of armature to trip mechanism that opens breaker when pull of operating spring overcomes attraction of magnet because of undervoltage condition.

(6) **SPRING ARM LINK**—Attached to circuit breaker mechanism at upper end. Releases linkage so that operating spring holds armature against pole faces of magnet when breaker is open. When breaker is closed, it sets arm so that spring tends to pull armature away from pole faces.

Hazards arising from power failure are well known to operating men. The unexpected slowing or stopping of motor drives followed by equally unforeseen resumption of full speed can give rise to conditions damaging for d-c armatures and a-c windings, can do harm to machining and processing equipment, can injure workmen.

Protection against "undervoltage" is simple in principle. A drop to a predetermined, critical value causes a magnet to release an armature and the breaker opens. From that point, there need be no damaging current or unforeseen resumption of power or load.

Simple as this is, what you want on the part of the undervoltage trip is positive, dependable action. This I-T-E gives you—and we will gladly tell you about it to the last detail. Just call the nearest I-T-E representative or write to I-T-E Circuit Breaker Co., 19th and Hamilton Streets, Philadelphia 30, Pa.

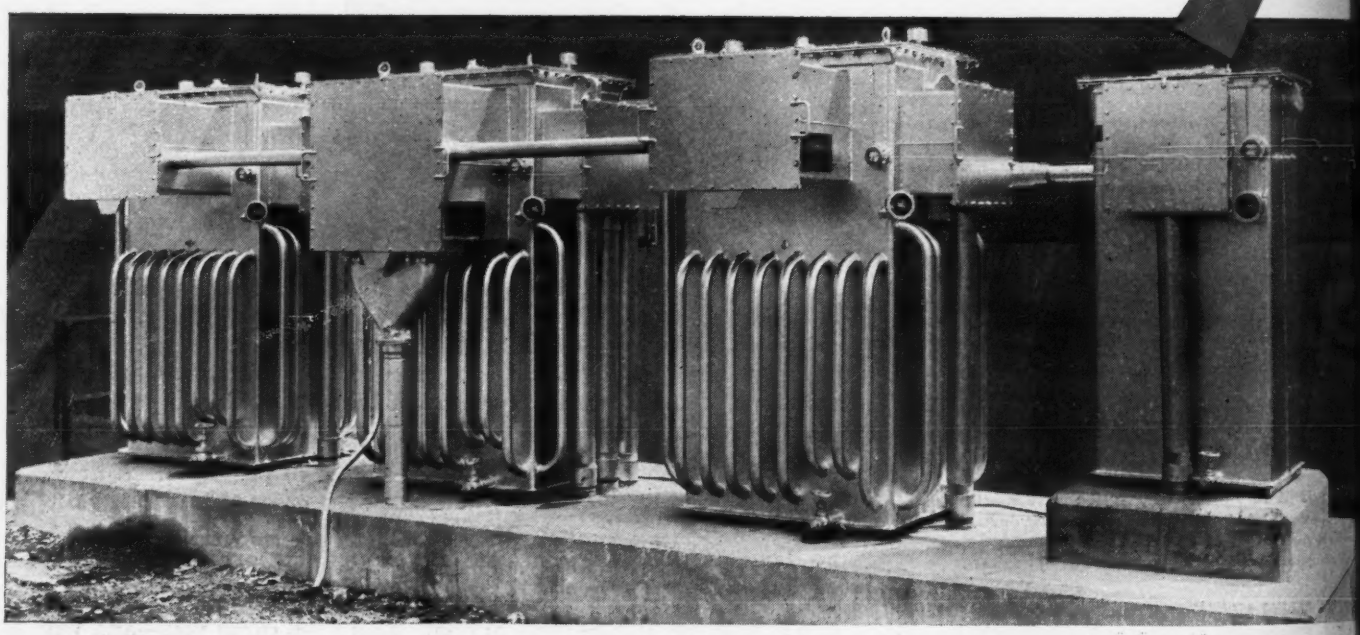
Representatives in Principal Cities

I-T-E AIR SWITCHGEAR

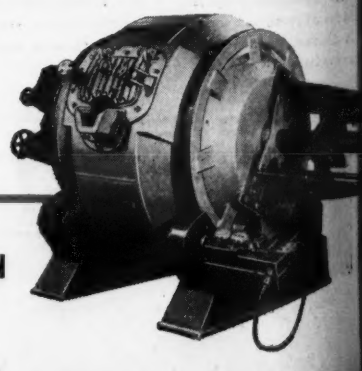
KUHLMAN TRANSFORMERS

STURDY • DEPENDABLE • EFFICIENT

From dam sites and power plants to manufacturing plants and homes, Kuhlman Transformers are transforming electrical energy efficiently day after day with a minimum of maintenance. Shown here is a bank of three—200 Kva, 60 cycle, single phase O. I. S C. Kuhlman Transformers 13800—7200/12470 Y volts with tertiary for 480/240 volts and one—100 Kva, 60 cycle, single phase O. I. S. C. Kuhlman Transformer 480-120/240 volts handling a part of the load from one of America's newer dams. For Power or Distribution Transformers (Saf-T-Kuhl, O. I. S. C., C. S. P. and Dry Type) or Line Regulators it will pay you to get facts and prices from Kuhlman.



In addition to transformers the Kuhlman Electric Co. also manufactures Detroit Rocking Electric Furnaces—a load building, revenue producing product. Using electricity rather than fuel, these fast melting, efficient furnaces are speeding up the production of essential war needs in ferrous and non-ferrous foundries and casting shops.



KUHLMAN ELECTRIC CO., BAY CITY, MICHIGAN